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Photo, E. C. Ogden.

JUNIPERUS VIRGINIANA; foliage, $\times 10$; seeds, $\times 10$: FIG. 1, from Missouri; FIG. 2, from Virginia; FIG. 3, from North Carolina; FIG. 4, from Tennessee; FIG. 5, from Missouri; FIG. 6, from North Carolina; FIGS. 7 and 8, from Virginia; FIG. 9, from Tennessee.

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THREE DAYS OF BOTANIZING IN SOUTHEASTERN
VIRGINIA

M. L. FERNALD AND LUDLOW GRISCOM

³³²⁻³⁵¹
(Plates 232-251)

IN recent ornithological and botanical trips to the southeastern United States the junior author had been impressed with the distinctively austral elements which extend northward on the outer coastal plain and an earlier experience on a spring trip to the region of Back Bay in Princess Anne County, Virginia, had vividly indicated the need for fuller collections, especially in technical groups, from that southeast corner of the "Manual range." The first extensive collections from Virginia were those of the younger John Clayton, who botanized largely, for the time, in Gloucester County and doubtless elsewhere in eastern Virginia and secured plants from as far west as the Shenandoah Valley. Upon Clayton's collections Gronovius based his *Flora Virginica Exhibens Plantas Quas V. C. Johannes Clayton In Virginia Observavit atque collegit* (1739). Gronovius, with the aid of Linnaeus (then a young student) gave very detailed descriptions (but without binomials) of the Clayton plants, and in 1753 Linnaeus, in *Species Plantarum*, rested many scores of binomials wholly or primarily upon the Gronovian descriptions and the Clayton specimens, which he had formerly studied. Southeastern Virginia is, therefore, the TYPE-REGION of a large number of Linnean species; and very detailed collecting is needed there in order clearly to interpret what Gronovius and Linnaeus actually had before them. To a

great extent, of course, the identities can be determined through study of the actual specimens of Clayton, now scrupulously preserved at the British Museum of Natural History. Asa Gray and numerous other American botanists have made notes based upon study of these Clayton plants, and each of the present authors has studied special types. Unfortunately, however, no one without intensive knowledge of the flora of eastern North American, and particularly of eastern Virginia, can properly interpret them; for in many groups the plants of southeastern Virginia prove, upon field acquaintance, to be quite different from the more northern or inland species or varieties which have been identified with them.

With the double hope of securing fresh material of critical plants from not too far away from Clayton's collecting-grounds and of extending northward into southeastern Virginia species already known from the coastal plain of North or South Carolina, we left Cambridge, after a very early breakfast, on the morning of September 20, 1933, for the region of Cape Henry. With only five days before we must be back in Cambridge, no slack time was allowable; we reached Morristown, New Jersey, for lunch and drove aboard the Norfolk ferry at Cape Charles in the evening, 585 miles from Cambridge. Establishing ourselves at Virginia Beach we began, at noon on the 21st, three days of unremitting collecting: two sheets each of every species not already quite familiar or of members of technical groups in which special study seemed needed. Working far into the night and cutting sleep to a minimum we secured and brought back to Cambridge the series of specimens which forms the basis of this report. It very soon became evident that many species had been quite misinterpreted or hastily and inconclusively dealt with in the past; consequently our necessarily limited series, collected at the close of September, has occupied the late afternoons of many days during two academic years. And, even now, many highly technical groups can not be dealt with. They await further comparisons with the Clayton and other types of Linnaeus or with those of Walter, Lamarck, Poiret and Michaux and will be considered in a later paper.

One feature of the outer coastal plain of Princess Anne County, for which we were not prepared, was the relative abundance there of Alleghenian types, growing in close proximity to the typical coastal plain species. *Oxydendrum arboreum* is common; typical *Juniperus virginiana* of the limestone bluffs of Tennessee and Missouri abounds; and our collections include *Laportea canadensis* and some other up-

land species. The work of the late E. J. Grimes showed a similar intrusion into the outer coastal plain of plants typical of the interior. In Princess Anne County the presence of large areas of neutral to calcareous clays side-by-side with acid sands and peats seems to be the factor which favors this blending of floras. Further study of the region in the summer of 1934 by Fernald and Long greatly increased the number of Alleghenian species known in this outermost county of southeastern Virginia.

In the summer of 1934 the junior author studied many types in London and Paris, and from the discussions following it will be seen how frequently these have been misinterpreted. The case of *Lippia lanceolata* is typical. Michaux described the species from the outer coastal plain of South Carolina. No material of this plant was known to Asa Gray but a similar plant of the interior, having broader leaves, has regularly passed as *L. lanceolata*, Gray specially noting, in the Synoptical Flora, the plant of the interior with leaves "varying from obovate and lanceolate-spatulate to ovate" and Michaux's "name therefore inapt." We now have characteristic material from southeastern Virginia and southeastward on the coastal plain which shows that Michaux's name was "apt!"

Very recently the activity of the botanists of Virginia has found an outlet in the new journal, *Claytonia*; this evidence of renewed interest in the flora of the state is most welcome and much clarification of identities as well as knowledge of local distribution is looked for. The results, so far as yet worked out, of study of our own fruits of three days of collecting are here given. In some cases, it will be noted, our collections of September, 1933, are supplemented by the specimens secured in late July and early August, 1934, by Fernald and Long. The fuller report on this later collection is now being prepared by the senior author. In the illustration of the present paper we have had the unexcelled help of Professor J. FRANKLIN COLLINS, who has freely given his services in preparing several of the plates, while others have been prepared by Mr. E. C. OGDEN. The expenses involved in their preparation and in the making of the half-tone blocks have been met by a grant to the senior author from the Milton Fund for Research of Harvard University; and the large cost of reproducing the blocks has been most generously defrayed by Mr. BAYARD LONG. Our keen appreciation of and thanks to those who have thus aided us is here publicly expressed.

and 333).—In the course of field-work in the South we and others before us (notably Mr. Francis Hunnewell and Dr. H. K. Svenson) have been greatly impressed with the very different aspect of much of the Red Cedar of the South as compared with that of the North. Many of the southern trees lack the stiff, narrowly pyramidal or spire-like outline so characteristic of the northern tree, the outline of the crown being more ovoid, with the lower branches widely spreading or more pendulous, regardless of whether the trees are fruiting or sterile. A thorough study of specimens shows that these habitual differences are usually accompanied by certain technical characters. In much of the southern material, from southeastern Virginia to Missouri and southward, chiefly in argillaceous or calcareous areas, the leaves of the adult branchlets (PL. 332, FIGS. 1-3) are tightly appressed, rather broadly deltoid and obtuse or merely subacute, while the base of the seed has deep and conspicuous pits (PLATE 332, FIGS. 5-8). In the northern tree, of more sterile to acid soils, the leaves of the adult branchlets are narrower and attenuate to sharp and with usually less appressed tips (PL. 333, FIGS. 1-4), and the seeds (PL. 333, FIGS. 5-8) have only shallow basal pits. A large series of specimens from the coastal plain, from New Jersey to southeastern Massachusetts, is somewhat intermediate; while the characteristic northern extreme extends southward, chiefly in the mountains, to North Carolina and locally to Missouri.

In seeking the proper names for these two very real geographic varieties it is necessary first to identify typical *Juniperus virginiana* L. Linnaeus, Sp. Pl. 1039 (1753) quoted his earlier diagnosis from *Hortus Cliffortianus*, with references to Gronovius, Royen, Ray and Sloane. The latter, referring to a West Indian tree, can be dismissed as having nothing to do with the species of "Virginia, Carolina." The brief diagnoses in *Hortus Cliffortianus* and in Gronovius are not sufficiently definite to show which variety was in hand. The junior author, however, made close examinations of the specimens concerned while in London in the summer of 1934. The *Hortus Cliffortianus* specimen (no. 464) is the end of a young shoot, showing only the juvenile foliage and none of the appressed scales necessary for identification. The Clayton specimen (no. 884) which was the basis of the primary diagnosis of Gronovius is clearly the southern variety. In the Linnean Herbarium there is also a specimen of *J. virginiana*, and this is probably the northern extreme, although the mature scales are just forming and, consequently, are not wholly characteristic. In

view of the fact that in the *Species Plantarum* Linnaeus gave no new diagnosis, his species should be typified by the first cited specimen which is identifiable. This is the Clayton specimen described by Gronovious. Typical *J. virginiana* is, accordingly, the broader- and blunter-leaved southern tree.

Many varietal, subspecific and specific names have been proposed within the group but they are all vague or confused in their application, except for numerous minor horticultural forms. *J. caroliniana* Mill. (1768),¹ *J. arborescens* Moench (1794) and *J. fragrans* Salisb. (1796) were mere renamings of *J. virginiana* L. *J. virginiana*, β, *J. caroliniana* Willd. (1796) was based on *J. caroliniana* Mill. *J. virginiana* *Hermannii Pers. (1807), as defined, seems to have had the adult and juvenile foliage confused. *J. virginiana*, A. *vulgaris* Endl. (1822) was simply *J. virginiana* in the aggregate, as contrasted with his B. *australis*, which is *J. barbadensis* L. *J. virginiana*, var. *montana* Vasey (1876) was from Utah and Colorado, published without any stated technical characters; at least it is not the northeastern tree. It seems, therefore, that the two varieties, as such, have not been clearly differentiated; and that the northern more widely ranging extreme should be called

JUNIPERUS VIRGINIANA L., var. **crebra** var. nov. (TAB. 333), foliis maturis anguste ovatis acutis, apice vix arcte adpressis; seminibus basin versus leviter foveolatis.—TYPE: dry open gravelly soil, Barnstable, MASSACHUSETTS, July 24, 1919, Fernald & Long, no. 17,797 in Gray Herb.

Whereas the foliage of adult branchlets is usually distinctive, it is sometimes transitional; but the most fundamental difference is in the pitting of the seeds. Thus, specimens from "large trees with pendulous branches" collected near Waynesboro, Wayne Co., Tennessee (Svenson, no. 4308) are of such transitional material, with habit of typical *J. virginiana*, leaves (PL. 332, FIG. 4) of var. *crebra*, but seeds (FIG. 9) very definitely of the southern type. In separating the seeds from the flesh we have gently chewed hundreds of fruits. It is significant that fully ripe fruit of the southern typical *Juniperus virginiana* has a strong pitchy flavor without any ameliorating sweetness, whereas the ripe fruit of var. *crebra* usually has sweet flesh.

TRIODIA FLAVA (L.) Hitchc., var. **Chapmani** (Small), comb. nov. *Sieglungia Chapmani* Small, Bull. Torr. Bot. Cl. xxii. 365 (1895). *Triodia Chapmani* (Small) Bush, Trans. Acad. Sci. St. Louis, xii. 74 (1902). *Tridens sesleriorides*, var. *Chapmani* (Small) Nash, Fl. Se.

The detailed references are all given by Sargent in the *Sylva*.

U. S. 142 (1903).—Range extended north to southeastern Virginia: dry oak woods, "The Desert," Cape Henry, no. 2758.

T. FLAVA, var. *aristata* (Scribn. & Ball), comb. nov. *Triodia seslerioides*, var. *aristata* Scribn. & Ball, U. S. Div. Agrost. Bull. xxiv. 45 (1900).

Var. *Chapmani* is distinguished from typical *Triodia flava* by its usually more pedicelled spikelets, which are commonly fewer-flowered, by its smoother and more attenuate lemmas, by the longer and more lanate tufts at the bases of the branches, and by the very slender basal sheaths. The branches are more inclined to be widely divergent. In our material all these characters are developed to an extreme degree, so much so that in the field we failed to recognize the true affinity of the plant.

Var. *aristata*, well characterized in the original diagnosis, seems to be a highly localized extreme in Florida.

In the extreme West and Southwest of the range of the species there are several minor tendencies but not sufficiently constant to merit taxonomic recognition. One of these was the basis for *Triodia cuprea*, var. *intermedia* Vasey, Contr. U. S. Nat. Herb. i. 201 (1892), published merely as a *nomen nudum* for C. S. Sheldon's no. 273 from near Fort Sill, Oklahoma (Indian Territory). This variety was afterwards validated by its publication with diagnosis as *Sieblingia seslerioides*, var. *intermedia* Vasey ex Dewey, Contr. U. S. Nat. Herb. ii. 539 (1894). Professor Hitchcock, who has kindly loaned us a sheet of Sheldon's collection in the United States National Herbarium, as well as the type of var. *aristata*, writes that the sheet no. 273 was not retained at Washington, and that, consequently, another (but unnumbered) sheet of Sheldon's material has there been taken to be the type. Fortunately, however, sheet no. 273, which was long ago sent in exchange from the National Herbarium to the Gray Herbarium, contains two culms, one of which has been returned to Washington. This material, although younger, seems to us to differ in no fundamental character from the other Sheldon plant which had been retained at Washington. Var. *intermedia*, as already intimated, seems hardly separable from typical *T. flava*.

Tricuspidis seslerioides, var. *pallida* Holm, Proc. Biol. Soc. Wash. xiv. 19 (1901) is only a minor form with greenish spikelets.

ERAGROSTIS HIRSUTA (Michx.) Nees. Admitted in the 2d edition of Britton & Brown (1913) on the basis of a report by Kearney. The species seems to be common in southeastern Virginia.

SPARTINA PATENS (Ait.) Muhl., var. *JUNCEA* (Michx.) Hitchc.

Pools in sandy pine barrens, Cape Henry, Virginia, *Fernald & Griscom*, no. 2711.

The extraordinary habitat, strictly fresh pools, where it was associated with *Xyris* and other typical pine barren species, led us to hope that we had a unique *Spartina*. We are unable to find any character, however, to separate it from the ordinary plant of the coast.

CINNA ARUNDINACEA L., var. *inxpansa*, var. nov. (TAB. 334, FIGS. 1 et 2), a forma typica differt paniculis contractis ramis valde adscendentibus; spiculis brevioribus 3.7–4.2 mm. longis; glumis linear-lanceolatis, inferiore hyalina glabra carina scabra evanescenti excepta, superiore lemmati aequante vel quam eo breviore.—TYPE: damp woods, Virginia Beach, VIRGINIA, August 8, 1934, *Fernald & Long*, no. 3648. Collected by us in edge of gum swamp, North Landing, Norfolk Co., no. 2732; damp pine barren, Macon's Corner, Princess Anne Co., no. 2733. Specimens, without definite locality given, from LOUISIANA, *Hall*, and from OKLAHOMA, 1891, *C. S. Sheldon*, no. 291, seen to be identical with ours.

Typical *Cinna arundinacea* of more northern or inland range, the type from Canada (presumably near Montreal), has the larger panicle in maturity with spreading to flexuous branches; the spikelets (FIG. 3) 4.5–6 mm. long; 1st glume subherbaceous, hyaline only along the margin, strongly scabrous-hispid on the back, the 2d glume usually nearly equaling to exceeding the lemma. The typical plant follows south in the piedmont and upland regions to Georgia. Var. *inxpansa* is apparently confined to the Coastal Plain of the Gulf and South-eastern States. In southeastern Virginia it seemed to be frequent, but all the specimens seen in 1933 had the foliage badly damaged, probably by the violent storms of the summer.

Var. *inxpansa*, the most austral representative of the genus in the eastern United States, combines in a remarkable manner the technical characters of *Cinna arundinacea* and the boreal *C. latifolia* (Trev.) Griseb. The latter species, of circumboreal range, occurs generally from southern Labrador to southern Alaska, thence south into the wooded northern states and along the mountains of North Carolina (4000–6000 ft.), Tennessee (6500 ft.), Colorado and California. Yet, in its short spikelets with hyaline 1st glume *C. arundinacea*, var. *inxpansa* of the southern Coastal Plain is very close to *C. latifolia* (FIG. 4). It has, however, the habit, unequal glumes, firm 2d glume and long anthers (1.2–1.5 mm. long, those of *C. latifolia* 0.5–0.8 mm.) of *C. arundinacea*; and numerous specimens from Oklahoma and Arkansas clearly connect it with the latter species.

ARISTIDA LANOSA Muhl., var. *macera*, var. nov. (TAB. 335), a forma

typica recedit culmis solitariis vel subsolitariis filiformibus 4.5–7 dm. high; foliis vix 2 mm. latis inflorescentia aequantibus vel superantibus, vaginorum tomento sparsiore; panicula 1–2.2 dm. longa ramis simpli-cibus quam plurimum 2 cm. longis; glumis subaequantibus 8–16.2 mm. longis; arista media 2.5–3.5 cm. longa; antheris 3–3.5 mm. longis.—VIRGINIA: dry oak woods, Cape Henry, September 23, 1933, Fernald & Griscom, no. 2719 (TYPE in Gray Herb.; isotype in herb. Griscom).

Typical *Aristida lanosa* is ordinarily 0.8–1.5 m. high, with stoutish culms often in tufts; the leaves much shorter than the culms, 3–6 mm. wide, with sheaths densely lanate; panicle decomound, 3–7 dm. long, with elongate branches; 1st glume 12–21 mm. long, notably exceeding the 2nd; middle awn 1.5–3 cm. long; anthers 5.5–6 mm. long. Var. *macra* was so very distinct in the field that its relationship to *A. lanosa* was not suspected, in spite of our having seen the latter in abundance the preceding day. Typical *A. lanosa*, in characteristic development, also occurs at Cape Henry, in sandy pine woods (our no. 2716),

ARISTIDA PURPURASCENS Poir., var. *MINOR* Vasey. In his recent *Critical Revision of the Genus Aristida* Henrard defines var. *minor* more sharply than was originally done by Vasey by giving measurements of the specimen accepted by Hitchcock as the type: 1st glume 9 mm. long, 2d glume 8 mm., lemma 6 mm., central awn 22 mm. Examination of 15 sheets from the extreme Southwest and the Gulf States shows this thinner-panicled and less cespitose extreme there to be the prevailing form. As a matter of fact, the maximum measurement for the 1st glume proves to be 9 mm. and the minimum 6.5 mm., with the majority 8 mm. or less. The variety ranges from Texas to Florida, thence northward near the coast to southeastern Virginia. Our collection, apparently the first from north of South Carolina, is from dry thickets, Cedarville, Norfolk Co., September 22, 1933, no. 2717. In the field the plant was not recognized as *A. purpurascens*, because of its small tufts and thin panicle.

PANICUM LONGIFOLIUM Torr., var. *COMBSII* (Scribn. & Ball) Fern. RHODORA, xxxvi. 69 (1934). Wet pine barrens, Macon's Corner, Princess Anne Co., no. 2737.

Not recorded by Hitchcock and Chase from north of Georgia.

ECHINOCHLOA PUNGENS (Poir.) Rydb., var. *coarctata*, var. nov. (TAB. 336, FIGS. 1 et 2), paniculis densifloris ramis coarctatis; spiculis 3.5–4.5 mm. longis valde aristatis; lemmatibus glabris vel dorso tantummodo puberulis sparse ciliatis spiculis bullatis.—VIRGINIA: brackish marsh of North Landing River, Pungo Ferry, Princess Anne

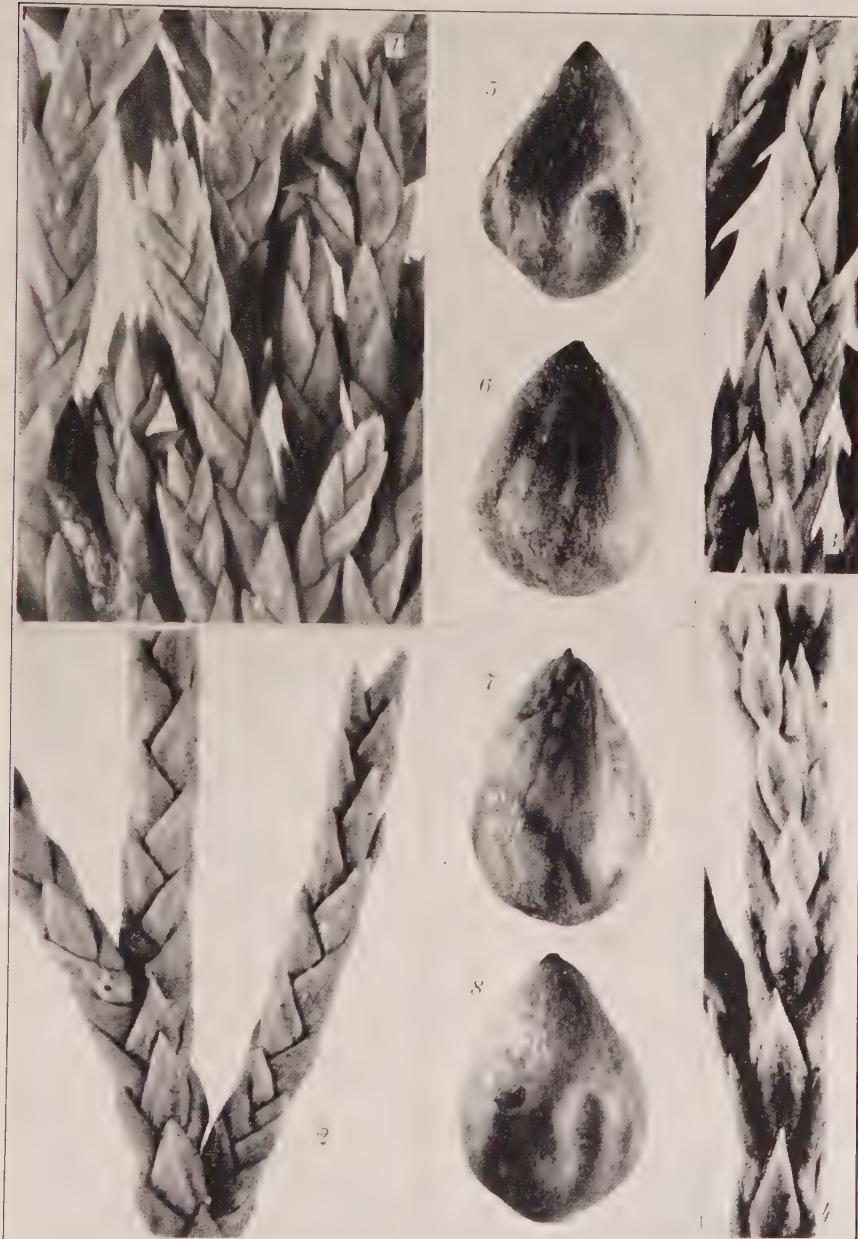


Photo E. C. Ogden.

JUNIPERUS VIRGINIANA, var. CREBRA; foliage, $\times 10$; seeds, $\times 10$: FIG. 1, from Pennsylvania; FIG. 2, from Massachusetts (type); FIG. 3, from Connecticut; FIG. 4, from New York; FIG. 5, from Pennsylvania; FIG. 6, from Connecticut; FIG. 7, from New York; FIG. 8, from Massachusetts (TYPE).



Photo, J. F. Collins.

CINNA ARUNDINACEA: FIG. 3, spikelets, $\times 12$. C. ARUNDINACEA, var. INEXPANSA:
FIG. 1, panicle, $\times 1$; FIG. 2, spikelets, $\times 12$. C. LATIFOLIA: FIG. 4, spikelets, $\times 12$.

Co., September 22, 1933, *Fernald & Griscom*, no. 2760 (TYPE in Gray Herb.; isotype in herb. Griscom).

When the combination *Echinochloa muricata* (Michx.) Fern., based on *Panicum muricatum* Michx. (1803), was proposed in *RHODORA*, xvii. 106 (1915) it was valid under the then existing International Rules. With the recent adoption of the homonym rule, however, it now becomes invalid because of the earlier *Panicum muricatum* Retz. (1786). The first available name for the species is *E. pungens* (Poir.) Rydb. *Brittonia*, i. 81 (1931), based on *Panicum pungens* Poir. in Lam. *Eneycl. Suppl.* iv. 273 (1816), which was itself a substitute for the invalid *P. muricatum* Michx.

The varieties of *Echinochloa muricata* defined by Wiegand become

E. PUNGENS, var. **ludoviciana** (Wieg.), comb. nov. *E. muricata*, var. *ludoviciana* Wieg. *RHODORA*, xxiii. 58 (1921). FIG. 3.

Var. **occidentalis** (Wieg.), comb. nov. *E. muricata*, var. *occidentalis* Wiegand, l. c. 58 (1921). *E. occidentalis* (Wieg.) Rydb. l. c. 82 (1931).

Var. **microstachya** (Wieg.) comb. nov. *E. muricata*, var. *microstachya* Wiegand, l. c. 58 (1921). *E. microstachya* (Wieg.) Rydb. l. c. 82 (1931).

Var. **multiflora** (Wieg.) comb. nov. *E. muricata*, var. *multiflora* Wieg. l. c. 59 (1921).

Var. *coarctata*, described above, has the panicle with appressed-ascending and crowded branches as in var. *ludoviciana* but with awns as in typical *E. pungens*. It differs from the other described varieties in having the sterile lemma glabrous or merely puberulent on the back, with the bullate-based spicules few and marginal or very rarely on the keel.

ECHINOCHLOA WALTERI (Pursh) Nash, forma **breviseta**, forma nov., aristis brevibus 3.5–4.5 mm. longis.—**VIRGINIA**: by Northwest Branch of North Landing River, North Landing, Norfolk Co., September 22, 1933, *Fernald & Griscom*, no. 2761 (TYPE in Gray Herb., isotype in herb. Griscom).

With the characteristic spikelets and hispid sheaths of *E. Walteri*, but with extraordinarily short awns, typical and common *E. Walteri* having the awns usually 1–2 cm. long.

ANDROPOGON TERNARIUS Michx. var. **glaucescens** (Scribn.), comb. nov. *A. Elliottii* *glaucescens* Scribn. *Bull. Torr. Bot. Cl.* xxiii. 145 (1896). *A. Scribnorianus* Nash, *Bull. N. Y. Bot. Gard.* i. 432 (1900). Our plant from **VIRGINIA**: pine barrens and open sandy barrens, Cape Henry, nos. 2762, 2763.

Var. *glaucescens* is a well marked extreme but without good morphological characters to separate it from *A. ternarius*. In several

cases specimens are definitely transitional. Our plants, representing the extreme variation, are, apparently, the first reported from north of Georgia, though material from North Carolina (Bat. Cave, Henderson Co., *Biltmore Herb.* no. 895^c) is equally characteristic.

We are unable, also, to keep apart as a species *A. Cabanisii* Hack. Numerous specimens are transitional from true *A. Cabanisii* to *A. ternarius* and its var. *glaucescens*. Extreme specimens are easily recognizable by the great reduction in length and abundance of the terminal internodal hairs of the rachis and by the more or less veiny backs of the sterile lemmas. As a variety this plant becomes

A. TERNARIUS, var. **Cabanisii** (Hack.), comb. nov. *A. Cabanisii* Hack. *Flora, lxviii.* 133 (1885).

Although Hackel cited *A. Cabanisii* from Pennsylvania, and, after him, Nash stated the range as "Pennsylvania (according to Hackel) and Florida," we have seen no material from north of North Carolina (Raleigh, *Ruth*, no. 578). Florida specimens distributed by A. P. Garber in 1877 bear a printed label with the address, "Columbia, Penna." It is surmised that the "Pennsylvania" record was based on such a specimen.

The specific lines between *A. ternarius* and *A. Elliottii* Chapm. have not always been clearly stated, as the separation of the two species on the alleged greater development of the spathe in *A. Elliottii* proves completely to break down in *A. Elliottii*, var. *gracilior* Hack. Although *A. ternarius* can usually be recognized by its very long peduncles, while the racemes of *A. Elliottii* are largely or completely included within the fascicle of large spathes, this character also breaks, for an extreme of the latter, chiefly from inland stations, has many long-exserted peduncles. The most stable characters, as given by Nash, are as follows: in *A. Elliottii* the sessile spikelet 3.5–5 mm. long, narrowly linear-lanceolate, equaling or somewhat exceeding the internodes; pedicel of sterile spikelet usually much longer than the sessile spikelet. In *A. ternarius* the sessile spikelet is more broadly lanceolate, 5–6 mm. long, about twice as long as the internode and equaling or clearly exceeding the pedicel of the sterile spikelet. Inspection of material shows that these are really fundamental characters.

A. Elliottii, as originally defined by Chapman and as shown by a sheet which he sent to Asa Gray, is the common coastwise plant of the Southeast, with enlarged spathes and included or mostly included racemes. In the northern part of its range inland, locally in Delaware,

Maryland, District of Columbia, western North Carolina and in southern Indiana, a well marked extreme occurs, in which most of the racemes are elevated on long peduncles, in this character suggesting *A. ternarius*. In this extreme the inflorescence is elongate, with well developed secondary lower branches. This plant, with notable geographic segregation, may be called

A. ELLIOTTII Chapm., var. **projectus**, var. nov., formae typicae simillima a qua differt inflorescentiis elongatis (2–4 dm. longis) fasciculis remotis, racemis superioribus valde exsertis longe pedunculatis.—TYPE from NORTH CAROLINA: open woods and abandoned fields, Biltmore, Buncomb Co., September 26, 1898, *Biltmore Herb.* no. 1421°. Other specimens are the following. DELAWARE: Wilmington, 1861, *Canby*. MARYLAND: sandy soil near Riverdale, October 3, 1911, *Holm*, as *A. argenteus*. DISTRICT OF COLUMBIA: old sterile field, Chevy Chase, September 24, 1922, *Agnes Chase*; without locality, September 22, 1896, *Steele*. INDIANA: Forest Reserve, Clark Co., *Deam*, no. 26,865.

A REVIEW OF *ANDROPOGON VIRGINICUS* AND *A. GLOMERATUS* (PLATES 337 and 338). In the northern half of the Atlantic coastal states botanists have long been familiar with two strikingly different plants, currently known as *Andropogon virginicus* L. (PL. 337, FIG. 1) and *A. glomeratus* (Walt.) BSP. (PL. 338, FIG. 3). The former, with slender culms and simple or subsimple, elongate inflorescences, is characteristic of dry habitats; the latter, with coarser culms and densely glomerate and subcorymbose or subturbinate inflorescences, of wet peats or marshes. From southeastern Virginia southward these two extremes, though very distinct in the North, are connected by a series of well marked variations, some of which have even been treated as species, but which in their spikelets show no definable differential characters.

The slender plant with simple or subsimple inflorescences (PL. 337, FIG. 1), which has generally passed as *A. virginicus*, is treated, correctly (as shown by an examination of the type by the junior author and by a photograph of it sent to the Gray Herbarium), by both Hackel and Nash as true *A. virginicus*: var. α , *viridis*, subvar. 1. *genuinus* Hackel. Although Hackel distinguished various green and more or less glaucous plants as varieties and subvarieties, these characters, when not accompanied by other differences, seem of slight taxonomic importance. Typical *A. virginicus*, whether green or glaucous, passes insensibly into a commoner southern tendency (PL. 337, FIG. 3) with generally coarser habit and branching or paniculate inflorescences but without any apparent differences of spathes or

spikelets. This is *A. tetrastachyus* Ell. Sk. i. 150 (1816) or *A. virginicus*, var. *tetrastachyus* (Ell.) Hack. in DC. Monogr. Phan. vi. 411 (1889). Although Nash does not recognize var. *tetrastachyus* as distinct from *A. virginicus*, it is very strikingly different in the field to northern-trained eyes and its concentration in the South but absence from the North marks it as a well defined geographic variety. Hackel conceived var. *tetrastachyus* as a plant with villous foliage, but this vegetative character is too fickle to be made the primary basis of varietal differentiation. Otherwise there seems to be no appreciable difference between var. *tetrastachyus*, as conceived by him, and his var. *viridis*, subvar. *ditior*, "paniculae valde ramosae rami primarii 2-3ⁿⁱ, 3-5-nodes, secundarii 3-5ⁿⁱ, 1-3-nodes, saepe tertianos procreantes," a plant of which Hackel pertinently remarked: "Transitum indigitat in *A. macrourum*, a quo tamen differt panicula laxa, laminis foliorum superiorum brevissimis nec paniculam aequantibus."

This variety, *A. virginicus*, var. *tetrastachyus* (including Hackel's var. *viridis*, subvar. *ditior*), strongly simulates another southeastern series of plants (PL. 337, FIG. 4) which have been separated as *A. macrourus* Michx., var. *glaucopsis* Ell. Sk. i. 150 (1816) and Hack. l. c. 409 (1889) or *A. glomeratus glaucopsis* (Ell.) Mohr, Bull. Torr. Bot. Cl. xxiv. 21 (1897). Although Nash subsequently made the combination *A. glaucopsis* (Ell.) Nash in Small Fl. Se. U. S. 62 (1903), it is apparent from his subsequent merging of his own *A. glaucopsis* with his earlier-published and very different *A. capillipes* Nash (PL. 337, FIG. 2), that his conception was a confused one, that glaucousness alone, regardless of other characters, was relied upon by him. True *A. macrourus*, var. *glaucopsis* was placed by Elliott and, following him, by Hackel under *A. macrourus* Michx. because the inflorescence has a tendency to produce glomerulate clusters. Examination of the type of *A. macrourus* shows that this identification was correct. Although theoretical *A. glomeratus* should have the leaves overtopping the inflorescence and the spathes scabrous, much of *A. macrourus* and material transitional to it has the leaves short and the spathes quite smooth, though the leaves in the extreme plant are very strongly pruinose-glaucous. It is this transitional series, very clearly described by Hackel as having a loose inflorescence and the spathes smooth, a characteristic of *A. virginicus* ("vaginis laminisque subtus valde pruinosus, glabris; panicula varietatis α [true *A. macrourus*], sed laxior"), extending north along with *A. virginicus*, var. *tetrastachyus* and true *A. macrourus* (PL. 337, FIG. 4) to southeastern Virginia,

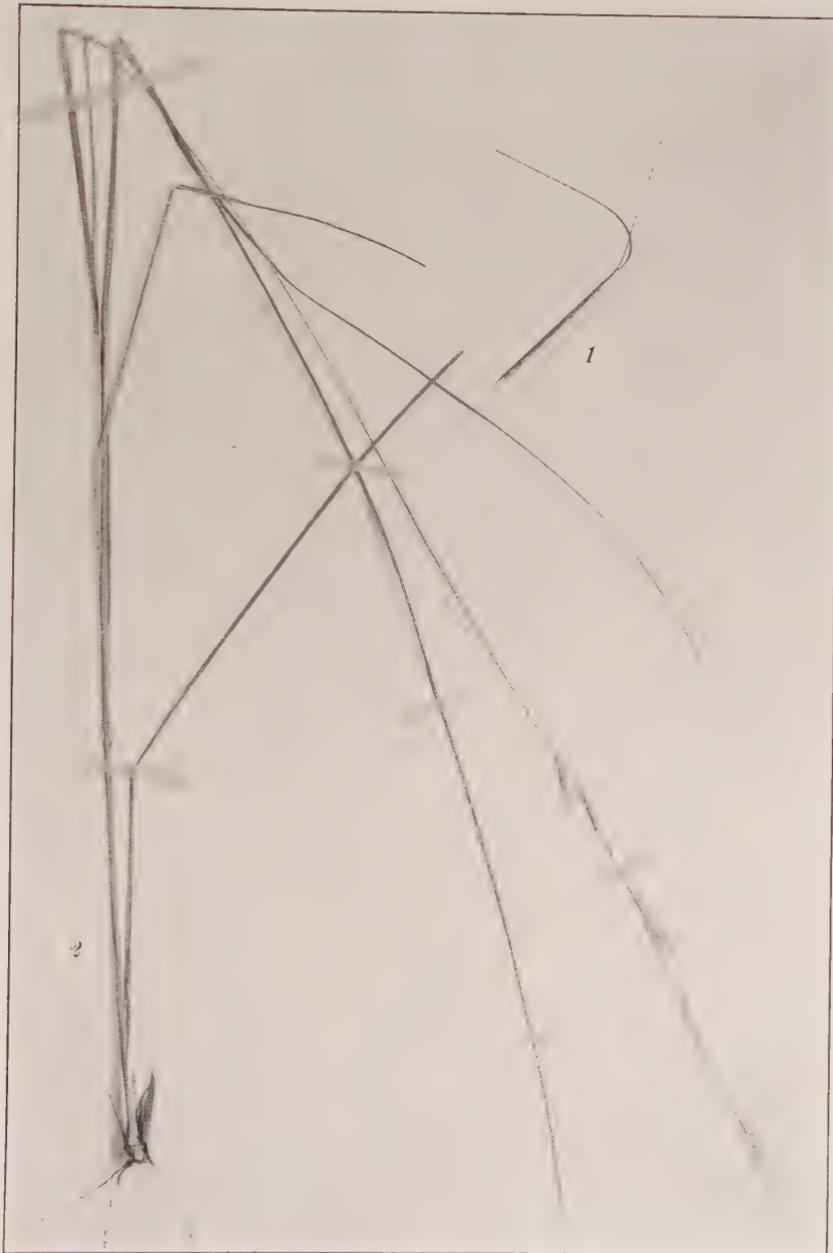


Photo. J. F. Collins.

ARISTIDA LANOSA, VAR. MACERA: FIG. 2, plant, $\times \frac{1}{2}$; FIG. 1, lemma, $\times 2$.



Photo, J. F. Collins.

ECHINOCHLOA PUNGENS, var. COARCTATA: FIG. 1, panicle, $\times 1$; FIG. 2, spikelet, $\times 10$.

E. PUNGENS, var. LUDOVICIANA: FIG. 3, spikelet, $\times 10$.

which makes it quite impossible to keep apart as valid species *A. virginicus* and *A. glomeratus*.

As a natural step from *A. glomeratus*, var. *glaucoptosis* we pass in the same southern region directly to the much commoner var. *tenuispathaeus* (PL. 338, FIG. 1), which usually has the inflorescence denser and thicker and more markedly glomerulate and which lacks the very pronounced bloom of var. *glaucoptosis*. The var. *tenuispathaeus* has the inflorescence elongate-ellipsoid, commonly 2–8 dm. long, but both northward and southward it passes imperceptibly into extremes with greatly shortened and corymbiform or turbinate panicles. The northern extreme (PL. 338, FIG. 3), with highly scabrous spathes is *A. macrourus*, var. *abbreviatus* Hack. l. c. 408 (1889). It has its greatest development from the District of Columbia and southern New Jersey to southeastern Massachusetts. Much farther south, especially from Florida to Texas, a similar extreme (PL. 338, FIG. 2), with exactly similar inflorescences, var. *corymbosus* Chapm. in Hack. l. c. 409 (1889), differs only in having the spathes smooth as in *A. virginicus*.

In the extreme South some other local variations of *A. virginicus* occur, which have been treated as distinct species, but these, having the simple inflorescences and smooth spathes of typical *A. virginicus*, do not specially concern us here. In order to show the variations (often treated as species) which seem to us to break down the reputed specific lines between *A. virginicus* and *A. glomeratus*, Professor J. F. Collins has most kindly supplied the photographs of typical panicles, $\times \frac{1}{2}$, reproduced as PLATES 337 and 338.

As we understand *Andropogon virginicus* it consists of the following variations which seem most worthy of recognition.

- a. Inflorescence simple or subsimple: culms slender: plants of dry soil.
 - Leaves flat, 2–5 mm. broad.....*A. virginicus*, var. *genuinus*.
 - Leaves subfiliform, canaliculate, 1–2 mm. wide.....Var. *stenophyllus*.
- a. Inflorescence branching, loosely to densely paniculate or corymbiform....b.
 - b. Branches of panicle never glomerulate: culms slender:
plants of dry soil.
 - Racemes only 1.5–2 cm. long.....Var. *glaucus*.
 - Racemes 2.5–4 cm. long.....Var. *tetrastrachys*.
 - b. Branches of panicle from slightly to strongly glomerulate or corymbiform: culms stout: plants mostly of wet pine barrens or swamps...c.
 - c. Inflorescence elongate, not corymbiform: upper leaves shorter than to overtopping the culm.
 - Leaves, especially of basal tufts, heavily white-pruined: inflorescence rather lax, its upper half only 4–6 cm. in diameter.....Var. *glaucoptosis*.

- Leaves green or only slightly glaucous: inflorescences usually dense, their upper halves 0.6–2 dm. in diameter..... *Var. tenuispatheus.*
- c. Inflorescence strongly corymbiform or subturbinate, often strongly overtopped by the upper leaves.
- Spathes smooth..... *Var. corymbosus.*
- Spathes strongly scabrous..... *Var. abbreviatus.*

A. VIRGINICUS L., var. *genuinus*. *A. virginicus* L. Sp. Pl. i. 1046 (1753). *Var. viridis*, subvar. *genuinus* Hack. in DC. Monogr. Phan. vi. 410 (1889).—Rather general in the Southern States, extending north on dry soils to Massachusetts, New York, Ohio, Indiana and Missouri; also Mexico. PL 337, FIG. 1.

Var. *stenophyllus* (Hack.), comb. nov. *A. virginicus*, var. *viridis*, subvar. *stenophyllus* Hack. l. c. 411 (1889). *A. perangustatus* Nash in Small, Fl. Se. U. S. 62 (1903).—Georgia and Florida to Mississippi.

Var. *GLAUCUS* Hack. l. c. 411 (1889). *A. capillipes* Nash, Bull. N. Y. Bot. Gard. i. 431 (1900).—North Carolina to Florida and Mississippi. PL 337, FIG. 2.

Var. *TETRASTACHYUS* (Ell.) Hack. l. c. 411 (1889). *A. tetraстachyus* Ell. Sk. i. 150 (1816). *A. longiberbis* Hack. Flora, lxviii. 131 (1885). *A. virginicus*, var. *viridis*, subvar. *ditior* Hack. l. c. 411 (1889). *Sorghum longiberbe* (Hack.) Kuntze, Rev. Gen. 792 (1891).—General in the Southern States, extending north to southeastern Virginia, Tennessee, southern Illinois, Missouri and Oklahoma; also in Mexico. Our collection from VIRGINIA is: dry pine barrens, Cape Henry, no. 2764. PL 337, FIG. 3.

Var. *GLAUCOPSIS* (Ell.) Hitchc. Am. Journ. Bot. xxi. 139 (1934). *A. macrourus* Michx. Fl. Bor.-Am. i. 56 (1803). *A. macrourus* *glaucoptis* Ell. Sk. i. 150 (1816); Hack. l. c. 409 (1889). *A. glaucoptis* (Ell.) Nash in Small, l. c. 62 (1903), at least as to name-bringing syn.—Very local, Florida to southeastern Virginia. Our collection from VIRGINIA: edge of brackish marsh, Pungo Ferry, no. 2765. PL 337, FIG. 4.

Var. *tenuispatheus* (Nash) comb. nov. *A. glomeratus tenuispatheus* Nash in Small, Fl. Se. U. S. 61 (1903). *A. tenuispatheus* Nash in N. Am. Fl. xvii². 113 (1912).—General in marshes and damp pine barrens in the Southern States, westward to southern Nevada and southern California and Mexico, north to southeastern Virginia and Arkansas. Our collection from VIRGINIA: upper border of brackish marsh, Kempsville, no. 2766. PL 338, FIG. 1.

Var. *TENUISPATHEUS*, forma *hirsutior* (Hack.), comb. nov. *A. macrourus* γ, *hirsutior* Hack. l. c. 409 (1889).—Like var. *tenuispatheus* but sheathes conspicuously villous.—Georgia, Florida and Alabama.

Var. *corymbosus* (Chapm.), comb. nov. *A. macrourus*, ε, *corymbosus* Chapm. in Hack. l. c. 409 (1889). *A. corymbosus* (Chapm.) Nash in Britt. Man. 69 (1901), in part (as to southern plant).—Wet pine barrens, Florida to Arkansas, Texas and Mexico. PL 338, FIG. 2.

Var. *abbreviatus* (Hack.), comb. nov. *Cinna glomerata* Walt.

Fl. Carol. 59 (1788), the type examined by the junior author in 1934. *A. glomeratus* (Walt.) B. S. P. Prelim. Cat. N. Y. 67 (1888). *A. macrourus* β, *abbreviatus* Hack. l. c. 408 (1889).—Marshes and wet pine barrens, southeastern Massachusetts to District of Columbia and North Carolina. Pl. 338, FIG. 3.

THE VARIATIONS OF *ANDROPOGON SCOPARIUS* (PLATES 339 and 340).—In 1917 Mr. F. Tracy Hubbard pointed out that the typical *Andropogon scoparius* is the rather local plant of the Atlantic seaboard with strongly villous sheaths and blades. At that time Hubbard designated the widespread glabrous plants as var. *frequens* Hubbard, RHODORA, xix. 103 (1917), and concluded his article with a long discussion of var. *polycladus* Scribn. & Ball, to which he reduced the very striking plant of the northeastern seabeaches, *A. littoralis* Nash. His remarks, however, and the specimens he cited (omitting any citations from the type-region) indicate that his conception of var. *polycladus* had little to do with the plant of Scribner & Ball. In fact, Hubbard's citations show that any luxuriant or bushy-branched specimen of at least four well defined geographic varieties was called by him var. *polycladus*. Furthermore, the range given and the specimens labelled by him as var. *frequens* show that this concept was also a composite one. In attempting to make out the identities of our recent collections we have found that the species, *A. scoparius*, breaks into the following confluent but geographically somewhat isolated varieties, two of which are treated by Nash as species distinct from *A. scoparius*.

- a. Joints of rachis beardless for the basal third, the bearding relatively sparse and short, grayish-white: robust plants chiefly of southern range.
Sheaths copiously villous: inflorescence relatively simple,
with few appressed-ascending branches.....Var. *genuinus*.
Sheaths glabrous or more or less pubescent: inflorescence
with very forking fastigiate branches, the lateral branches
often horizontally divergent.....Var. *divergens*.
- a. Joints of rachis bearded nearly or quite to base, the bearding often longer and whiter: usually more slender plants of northern or inland range....b.
b. Glumes of fertile spikelet 4.5–6 mm. long: sterile rudiment,
including awn, 2.5–5.5 mm. long: bearding comparatively
sparse and short.....Var. *frequens*.
b. Glumes of fertile spikelet 6–11 mm. long: sterile rudiment,
including awn, 3–10.5 (usually 6 or more) mm. long:
bearding abundant and long....c.
c. Racemes with 5–10 fertile spikelets, usually very flexuous;
glumes 7–10 mm. long: rudiment 6.5–10.5 mm. long.
.....Var. *septentrionalis*.
c. Racemes with (8–)11–19 fertile spikelets, rarely flexuous....d
d. Inflorescence elongate, simple or subsimple, its
branches little, if at all, fastigiate: rudiment 3–4.5
mm. long: plant of interior and western area..Var. *neo-mexicanus*.

- d. Inflorescence shorter, with abundant fastigiate branching: rudiment 5–8.5 mm. long: plants of Atlantic coast.
 Sheaths only slightly compressed, often green:
 lower caudine blades barely exceeding the sheaths:
 glumes 6–8 mm. long *Var. ducis.*
 Sheaths strongly compressed, usually very glaucous:
 lower caudine blades greatly exceeding the sheaths:
 glumes 8.5–10 mm. long *Var. littoralis.*

Var. *genuinus*. *A. scoparius* Michx. Fl. Bor.-Am. i. 57 (1803). *Pollinia scoparia* (Michx.) Spreng. Pug. ii. 13 (1815). *A. scoparius*, subsp. *genuinus*, forma or subvar. *typica* Hackel in DC. Monogr. Phan. vi. 385 (1889). *Sorghum scoparium* (Michx.) Kuntze, Rev. Gen. 792 (1891). *A. scoparius villosissimus* Kearney ex Scribn. & Ball, Bull. U. S. Div. Agrost. 24: 41 (1900); Hubbard, RHODORA, xix. 101 (1917). *Schizachyrium scoparium* (Michx.) Nash in Small, Fl. Se. U. S. 59 (1903), at least as to source of name. *S. villosissimus* (Kearney) Nash, l. c. (1903).—Gulf States, locally north to Missouri and Kentucky and along the coast to Connecticut and Dukes and Nantucket Cos., Massachusetts. PLATE 339, FIG. 4.

The typical *A. scoparius* possibly extends farther north in the interior. Numerous specimens cited by Hubbard seem to be slightly pubescent individuals of other varieties, which differ from var. *genuinus* in characters of the racemes.

Var. *DIVERGENS* Hackel, l. c. 385 (1889). *A. divergens* Anderss. ex Hackel, l. c. as syn. Var. *polycladus* Scribn. & Ball, Bull. U. S. Div. Agrost. 24: 40 (1900); Hubbard, l. c. 103 (1917), in small part only.—Florida to Texas and Mexico, northward to Arkansas and, very locally, to Delaware Co., Pennsylvania. PLATE 340, FIG. 3.

The type-sheet of var. *polycladus* has been most kindly loaned to us by Professor Hitchcock. Its characteristic branching and robust stature indicate its identity with Hackel's *A. scoparius*, subsp. *maritimus*, β . *divergens* from Texas, characterized by "Rami floriferi robustiores, . . . racemi robustiores . . . Paniculae pauperae rami bini, primarii 2-3-nodes, hinc inde ramulosi." This very striking variety has had an unfortunate career, being either completely ignored or quite misinterpreted.

Var. *FREQUENS* Hubbard, RHODORA, xix. 103 (1917), as to TYPE, but otherwise only in small part. *A. purpurascens* Muhl. in Willd. Sp. Pl. iv. 913 (1806). *A. flexilis* Poir. in Lam. Encyc. Suppl. i. 583 (1810). *A. scoparius*, subsp. *genuinus*, forma vel subvar. *flexilis* (Poir.) Hackel, l. c. 384 (1889).—Western New Hampshire and eastern Massachusetts to central New York and locally to Minnesota, south to Florida, Alabama and Mississippi. PLATE 339, FIG. 3.

Hubbard's var. *frequens* included this and the next three varieties. The type (Block Island, Fernald, Long & Torrey, no. 8476) is the



Photo, J. F. Collins.

ANDROPOGON VIRGINICUS AND VARIETIES; panicles, $\times \frac{1}{2}$.
FIG. 1, var. GENUINUS; FIG. 2, var. GLAUCUS; FIG. 3, var. TETRASTACHYUS; FIG. 4, var.
GLAUCOPSIS.



Photo, J. F. Collins.

ANDROPOGON VIRGINICUS AND VARIETIES; panicles, $\times \frac{1}{2}$.

FIG. 1, var. TENUISPATHEUS; FIG. 2, var. CORYMBOSUS; FIG. 3, var. ABBREVIATUS.

common and characteristic extreme in most of the eastern states, becoming rare westward and apparently unknown southwestward, or northeast of western and southern New England.

Var. **septentrionalis**, var. nov. (TAB. 339, FIGS. 1 et 2), var. *frequenti* simillima a qua differt racemis laxis flexuosis; spiculis sessilibus 7–10 mm. longis; spiculis pedicellatis rudimentariis arista inclusa 6.5–10.5 mm. longis; rachillae pilis valde longioribus densioribusque.—St. John Valley, New Brunswick to Michigan, south to northeastern Massachusetts, western Connecticut and northeastern New York. TYPE: Baie Sherley, Riv. Ottawa, QUEBEC, 15 sept. 1925, Rolland, no. 19,199 (in Gray Herb.). Nearly all specimens seen from Quebec, Maine and New Hampshire, and all from New Brunswick belong here as do the following: VERMONT: Burlington, 1883, Brainerd; Norwich, 1889, M. A. Loveland; West Townshend, 1915, Wheeler. MASSACHUSETTS: Salisbury, Donald White, no. 340; Malden, 1880, H. A. Young; Randolph, 1898, Churchill. CONNECTICUT: Middletown, 1903, Driggs. NEW YORK: Lake George, 1900, E. C. Kent; Hudson Falls, 1899, Burnham. ONTARIO: Squirrel Island, Lambton Co., 1908, C. K. Dodge. MICHIGAN: Cheboygan Co., 1870, Beardslee.

Var. **NEO-MEXICANUS** (Nash), Hitchc. Proc. Biol. Soc. Wash. xli. 163 (1928). *A. neo-mexicanus* Nash, Bull. Torr. Bot. Cl. xxv. 83 (1898). *Schizachyrium neo-mexicanum* Nash in N. Am. Fl. xvii². 107 (1912).—The characteristic variety of the Rocky Mountain and Great Plains region, extending eastward along the Great Lakes to Lake Erie (Ontario, Ohio and Pennsylvania); apparently isolated in the Ottawa Valley and in the Androscoggin Valley, Maine. The extreme eastern collections are: QUEBEC: Ironside, valley of the Gatineau, Rolland, no. 15,291. MAINE: Gilead, 1897, Kate Furbish. PLATE 339, FIG. 5.

Var. **ducis**, var. nov. (TAB. 340, FIGS. 1 et 2), humilis; inflorescentiis fastigiatis; foliis viridiscentibus, laminis quam vaginis glabris et paullo compressis parum longioribus; spiculis sessilibus 6–8 mm. longis; spiculis pedicellatis rudimentariis arista inclusa 5–7.5 mm. longis.—Dukes, Nantucket and Barnstable Counties, MASSACHUSETTS. TYPE: steep, sandy bank, east side of West End Point, Naushon, August 31, 1927, J. M. Fogg, Jr., no. 2940 (in Gray Herb.).

Most of the specimens from Dukes County (Martha's Vineyard and the Elizabeth Islands) are thoroughly characteristic, but some from Cape Cod are transitional to var. *frequens*. Var. *ducis* has often been mistaken for the more southern var. *littoralis* (including a part of var. *polycladus* of Hubbard), but it differs strikingly in its greener color, less compressed sheaths, shorter blades and shorter glumes. We have seen no material from Nantucket, but Bicknell's comment upon reporting *Schizachyrium littorale* from there was to the point: "Specimens collected are less notably different from *S.*

scoparium than are strongly developed examples from the Long Island and New Jersey coasts." Bicknell's observation thus coincides with our own, that var. *ducis* is intermediate between vars. *frequens* and *littoralis*.

Var. *LITTORALIS* (Nash) Hitchc. RHODORA, viii. 205 (1906). *A. littoralis* Nash in Britt. Man. 69 (1901). *Schizachyrium littorale* (Nash) Bickn. Bull. Torr. Bot. Cl. xxxv. 182 (1908), as to type.—Beaches and dunes, southern Connecticut to southeastern Virginia. PLATE 340, FIG. 4.

Var. *littoralis* is so pronounced in its extreme development as to appear specifically distinct from the other varieties which are geographically adjacent, such, for instance, as vars. *divergens* and *frequens*. As will be seen, however, from an inspection of the key, vars. *septentrionalis*, *neo-mexicanus* (which on the sands of the Great Lakes has been identified as var. *littoralis*) and *ducis* completely bridge the morphological differences between these marked extremes. As already noted, on Cape Cod var. *ducis* clearly passes into the continental var. *frequens*; furthermore, the only Connecticut material we have seen of var. *littoralis* is greener than the plants of southern New York, New Jersey, Delaware and Virginia and is thus transitional to var. *ducis*.

VARIATIONS OF *ANDROPOGON PROVINCIALIS*.—The common grass which has long been known as *Andropogon furcatus* Muhl. (1806) must, unfortunately, take the earlier and inappropriate name *A. provincialis* Lam. (1783). This was based on specimens in cultivation or escaped from cultivation in Provence in southern France. Although Hackel treats the common *A. furcatus* of eastern America as a subvariety, the slight character which he ascribes to the plant introduced into France is found in a large number of American specimens. The native American plant is currently divided by Nash into four so-called species: *A. provincialis*, *A. chrysocomus* Nash, *A. tennesseensis* Scribn. and *A. paucipilus* Nash. Of these, *A. tennesseensis* is so trivial a variation, by no means confined to Tennessee, that it seems unworthy of recognition even as a form, a course just taken by Hitchcock in Small's Manual.

A. paucipilus is a well marked, rare and local extreme of Nebraska and Montana; but aside from its essentially glabrous racemes, the internodes with at most a few weak hairs, it has no morphological characters to separate it from the less pubescent tendencies of *A. provincialis*.

A. chrysocomus is a striking variation in the opposite direction, with the hairs of the internodes of the rachis more abundant, twice as long as in typical *A. provincialis* and, in its extreme development, yellowish in color. Except for the extreme development of beard there seems to be nothing to separate *A. chrysocomus* from *A. provincialis*.

The two extreme variations seem to us better treated as

A. PROVINCIALIS Lam., var. **paucipilus** (Nash), comb. nov.
A. paucipilus Nash in Britt, Man. 70 (1901).

A. PROVINCIALIS Lam., var. **chrysocomus** (Nash), comb. nov.
A. chrysocomus Nash, l. c. (1901).

Nash gives the range of the latter as "Nebraska and Wyoming to Texas," but recent collections show that it extends into southwestern Missouri.

CYPERUS IRIA L., var. **Santonici** (Rottb.), comb. nov. *C. Santonici* Rottb. Descr. Icon. Nov. Pl. 41, t. ix. fig. 1 (1773).

Botanists of the Orient have long recognized two marked trends in *Cyperus Iria*, which have been ignored by New World students. The commoner extreme is the slender-spiked plant which was beautifully illustrated by Plukenet. Linnaeus also cited a plate of Rheede, which, according to C. B. Clarke, is *C. inundatus* Roxb. Since Linnaeus had no specimens, the Plukenet plate must stand as the type. The typical variety, common in southeastern Asia as well as the southeastern United States, has the very short spikelets (2–10-flowered) practically sessile and alternately and irregularly crowded on both sides of the ultimate branches of the umbel, forming slender spiciform branches.

The other extreme, *Cyperus Santonici*, has much longer linear spikelets (10–22-flowered), terminating the ultimate branches of the umbel, forming shorter and thicker and looser ultimate racemes. Students of the oriental flora have treated this variety as typical *C. Iria*, and have considered the slender-spiked *C. Iria* as var. *microiria* (Steud.) Franchet & Savatier or as var. *paniciformis* (Franch. & Sav.) Clarke, or even as a separate species, *C. microiria* Steud. or *C. paniciformis* Franch. & Sav.

Typical *Cyperus Iria* is well known in our southeastern states, though it is significant that in 1860 Chapman knew of only a single station (Santee Canal), where it was considered as "Probably introduced from Eastern Asia." The abundance of the plant on roadsides and in clearings from North Carolina southward indicates a rapid naturalization.

The plant of southeastern Virginia (our nos. 2783-2785) proves to be not the typical *C. Iria* but the var. *Santonici*, which apparently has not been previously collected in America.

Hitherto the only basis for the inclusion of *C. Iria* in the Gray's Manual range has been a single collection at Hempstead, Long Island, first recorded in the 2nd edition of Britton & Brown's Illustrated Flora, a weed in a potato field, found by the late E. P. Bicknell in 1907. This plant, a sheet of which is before us, proves to be neither typical *C. Iria* nor var. *Santonici*, but is referable to *C. amuricus* Max. Prim. Fl. Amur. 296 (1859), a close relative of *C. Iria*, with which it has often been confused. One of the original specimens of *C. amuricus*, in the Gray Herbarium, is closely matched by Japanese material, differing at once from *C. Iria* in the prolonged midribs of the scales which project as definite cusps or mucros. *C. amuricus*, like *C. Iria*, seems to have a weedy tendency and is introduced in Italy, being *C. Iria*, var. *acutiglumis* Fiori, Fl. Ital. Exsicc. Ser. II. no. 1231 (1908). The plant, however, had an earlier varietal designation in *C. amuricus*, var. *iaponicus* Miq. Prolus. Fl. Jap. (1866-67), which was based on a trivial difference in color of the scales.

CYPERUS FERAX and *C. FERRUGINESCENS*.—The annuals variously known in American floras as *Cyperus ferax* Richard, Act. Soc. Hist. Nat. Paris, i. 106 (1792), *C. speciosus* Vahl, Enum. ii. 364 (1806) and *C. Michauxianus* Schultes, Mantissa, ii. 123 (1824) have never been clearly understood. Material identified under any one of these names occurs in our older herbaria, with an undifferentiated range from the Atlantic to the Pacific and south throughout tropical America; in habitat ranging from salt marsh to rich river-alluvium and prairie. In attempting to identify our own material it has been necessary to trace the various names to their sources.

C. ferax, the earliest described of the series, came originally from Surinam (Dutch Guiana), and an excellent photograph of the type (received through the Rockefeller Foundation and the Field Museum) shows it to be the plant characteristic of brackish or saline shores from tropical America north to Massachusetts and on the Pacific coast to California. This species is characterized by its coriaceous or subcoriaceous scales which are 2-3.5 mm. long, drab to brownish and inclined to be lustrous. Its achenes are 1.5-2 mm. long, ellipsoid to very narrowly obovoid, dull gray to blackish when ripe, with relatively coarse superficial pebbling.

Cyperus speciosus was described from Virginia, where *C. ferax* is



Photo. J. F. Collins.

ANDROPOGON SCOPARIUS AND VARIETIES; branches, $\times \frac{1}{2}$; racemes, $\times 2$.
FIGS. 1 and 2, var. SEPTENTRIONALIS; FIG. 3, var. FREQUENS; FIG. 4, var. GENUINUS;
FIG. 5, var. NEO-MEXICANUS.



Photo. J. F. Collins.

ANDROPOGON SCOPARIUS AND VARIETIES; habit, $\times \frac{1}{2}$; racemes, $\times 2$.
FIGS. 1 and 2, var. DUCIS; FIG. 3, var. DIVERGENS; FIG. 4, var. LITTORALIS.

abundant on the coast, as having the scales of the spikelets "linear" and leaves of the involucre only 2 lines wide. Torrey, following Elliott, applied this name to plants of the South "bearing conspicuous partial as well as general involucres." We know that in well developed umbels *C. ferax* may have them. Torrey did not know of *C. ferax* Richard and he applied to the smaller coastal plant with only primary involucres the name *C. Michauxianus* Schultes. This latter name was a substitute for *C. strigosus* Michx., not L.

In his extensive publication on the *Cyperaceae* of the Berlin Herbarium, Boeckeler performed some remarkable nomenclatural shuffles, restricting *C. ferax* to South America, and using the combination *C. Michauxianus* Torr. ("excl. syn Schult."), in spite of the fact that Torrey had explicitly stated that his *C. Michauxianus*, like that of Schultes, "is clearly the *C. strigosus* of Michaux, as I have ascertained by examining his herbarium." Of course *C. Michauxianus* of Torrey and of Schultes, earlier, are identical, being based on the identical type. Nevertheless, Boeckeler refrained from stating what he took to be *C. Michauxianus* of Schultes.

After attempting to find any character to distinguish these various plants we are forced to treat them as a single wide-ranging species for which *C. ferax* is the earliest name.

As to *Cyperus speciosus*, which Vahl based upon a specimen "ex herbario horti parisini," letters to Paris have brought the uniform reply that the type could not be found. The junior author, when in Paris in July, 1934, made a special search for this sheet with the expert assistance of Monsieur Léandri. It was finally located, but has always been previously overlooked, as the name *C. speciosus* does not occur on the sheet, nor did Vahl make any annotations. The evidence for this sheet being Vahl's type is as follows. There is only one label, bottom, left, in ink, which reads

Trasi Virgin. panic. speciosa sparsa herbier du Vaillant.

Now, Vahl, Enum. ii. 364 cites *C. speciosus* as being *ex herb. Vaillant*, and uses the same words in his third paragraph of diagnosis, merely substituting "*Cyperus*" for "*Trasi*:"

Cyperus virginianus panicula sparsa speciosa Herbarium Vaillantii.

Finally, this is the only Vaillant specimen of the species *C. ferax* and all its synonyms in the Museum.

The plant on the sheet is the culm and 2 inches of stem of a very large and long-branching specimen of *Cyperus ferax* with long spikes,

consequently lacking the congested appearance of many plants of that species. In technical characters it is NOT *C. erythrorhizos* nor *C. ferruginescens* but is the familiar *C. ferax* at a glance.

Boeckeler described two new species, *Cyperus ferruginescens*, Linnaea, xxxvi. 396 (1869-70) and *C. parvus*, l. c., both based on material sent by Engelmann from St. Louis, Missouri. The latter is clearly nothing but a depauperate state of the former. A sheet of the type-collection of *C. ferruginescens*, gathered by Engelmann near St. Louis, Missouri, in September, 1845 and sent to Gray as *C. Michauxianus* Schult. is a characteristic specimen of a species with small, opaque and membranaceous, instead of coarser, lustrous and coriaceous scales, which rarely exceed 2 mm. in length. The inflorescence of *C. ferruginescens* usually has a positively ferruginous coloring, that of *C. ferax* being drab to fuscous or, in the other direction, yellowish; the achenes of *C. ferruginescens* are also ferruginous or golden-brown, 1-1.5 mm. long, and shorter-oblong. *C. ferruginescens* occurs chiefly in the richer soils of the interior, coming eastward to the Connecticut and the Potomac valleys and extending westward to the Pacific. It has been distributed as *C. speciosus*, *ferax* or *erythrorhizos*, all of which it superficially simulates. In 1886 Dr. Britton considered it only a variety of *C. speciosus* Vahl, calling it *C. speciosus*, var. *squarrosus* Britt., Bull. Torr. Bot. Cl. xiii. 214 (1886); but he was then treating *C. speciosus* (including *C. speciosus*, var. *parvus* (Boeckl.) Britt. l. c.) as specifically distinct from *C. ferax* Richard.

THE VARIATIONS OF *CYPERUS STRIGOSUS* (PLATE 341). The widely dispersed species, *Cyperus strigosus* L. Sp. Pl. i. 47 (1753), has had many varieties proposed and at least three specific segregates. In searching for morphological characters to separate all these concepts we have spent many days in a study of the series. *C. strigosus* var. *capitatus* Britton, Bull. Torr. Bot. Cl. xiii. 221 (1886), wrongly ascribed to Boeckeler, who gave no name to it, seems to us only starved individuals with congested inflorescences. Var. *compositus* Britton, l. c., as shown by specimens so identified by Dr. Britton, is a series of more luxuriant plants with a compound umbel; while var. *gracilis* Britton, l. c. is another depauperate (or "drawn") state.

Var. *elongatus* (Torr.) Britton, l. c. was based on *C. Michauxianus*, β. ? *elongatus* Torr. Ann. Lyc. N. Y. iii. 432 (1836). Whether Torrey's type (*Drummond*, no. 337, from Texas) belonged to *C. strigosus* seems very doubtful. Torrey explicitly said of it: "much resembles *C.*

strigosus . . . but in the structure of the spikelets, it is nearer *C. Michauxianus*"; and Britton stated that he had never seen the Torrey type. Neither have we been able to locate it. Var. *robustior* Britton, l. c., based on *C. strigosus* β. Kunth, Enum. ii. 88 (1837), seems to be a well defined geographic variety, characterized by its very long (10–25-flowered) spikelets which are 2–3 cm. long; it is essentially a plant of the southeastern coastal plain, north locally to Martha's Vineyard and, in the interior, to southern Indiana and Missouri. Much of the material so named in collections is merely large *C. strigosus*.

One of the great technical difficulties in this species and its allies is the fact that quite immature specimens have subterete and not strongly compressed spikelets; consequently, immature specimens cannot be identified by keys which, in so technical a group, have to be based on mature fruiting material. On at least two occasions supposed new species have been based on such immature specimens. *C. uniflorus* Torr. & Hook. in Torr. l. c. 431 (1836), of which an isotype (our FIG. 2) is before us, was based on *Drummond's* no. 287 from Texas. It is wholly immature and is quite inseparable from much material in similar development from the northeastern states (see FIGS. 4 and 7). *C. Hansenii* Britton in Abrams, Ill. Fl. Pacif. States, i. 260, fig. 621 (1923), was based upon immature material ("young achene narrowly linear") from Amador County, California, with a stated range including Shasta Co. and the Sacramento Valley. Some of the earlier collections had been erroneously referred to *C. stenolepis* Torr. by Sereno Watson. This and some other material is before us and, again, it (see FIG. 5) is absolutely indistinguishable from innumerable immature specimens of *C. strigosus* from the breadth of the continent (FIG. 7 from Massachusetts).

Cyperus stenolepis Torr. l. c. 263 (1836) is in many ways the most extreme variety of *C. strigosus*, usually maintained as a species in works on the southern flora. It is characterized by luxuriant development, with the very numerous spikelets becoming lax, and with loosely spreading scales in maturity. In typical form it occurs chiefly from Florida to Louisiana, but it extends northward to North Carolina (whence the type) and locally to West Virginia. Dr. Gleason informs us that the type specimen cannot be found in the Torrey Herbarium; but Britton, in his synopsis of the genus, accepted it in the sense defined above and, until the type is discovered and proves to be something different, the name should be applied in its current sense. We agree with Kükenthal in treating it as *C. strigosus*, var. *stenolepis* (Torr.) Kükenth. in Fedde, Rep. Spec. Nov. xxiii. 189 (1926). lepis /

CYPERUS RETRORSUS AND ITS VARIATIONS (PLATE 342). The widespread species long known as *Cyperus cylindricus* (Ell.) Britton, Bull. Torr. Bot. Cl. vi. 339 (1871) became *C. Torreyi* Britton, Bull. Torr. Bot. Cl. xiii. 215 (1886) because of the earlier and different *C. cylindricus* Boeckl. (1859). In studying this variable species we have been unable, however, to keep *C. Torreyi* (1886) apart from *C. retrorsus* Chapm. Bot. Gaz. iii. 17 (1878). The latter (our FIGS. 1 and 2) represents one extreme of a series which includes the species *C. Nashii* Britton (FIGS. 3 and 4), *C. Deeringianus* Britton & Small (FIGS. 7 and 8) and *C. Torreyi* Britton (FIGS. 5 and 6), as treated in Small's Manual. So far as we can determine there are no fundamental differences between these plants, each of which has a distinctive range; and abundant intergradient specimens occur. As we should treat *C. retrorsus* it consists of the following varieties.

C. retrorsus Chapm., var. **typicus**. *C. retrorsus* Chapm. Bot. Gaz. iii. 17 (1878). *C. retroversus* Chapm.¹ Fl. So. U. S. ed. 2, 1st Suppl. 659 (1883), obvious *lapsus* for *C. retrorsus*, corrected in ed. 3.—Spikelets very densely crowded, the lower becoming reflexed, 2–3.5 mm. long, forming slenderly cylindric to slightly clavate spikes 0.9–2 cm. long.—Florida to Alabama and South Carolina (fragment of type at New York Bot. Gard. examined through courtesy of Dr. Gleason). FIGS. 1, \times 1, and 2, \times 4, from Florida material closely matching Chapman's type.

Var. **Nashii** (Britton), comb. nov. *C. Nashii* Britton in Small, Fl. Se. U. S. 1321 and 1329 (1903).—Spikelets less crowded, 2–3.5 mm. long, the lower more spreading, in ellipsoid-cylindric spikes 4–9 mm. long.—Heretofore recorded only from central Florida, but now extended north to southeastern VIRGINIA: Virginia Beach, Randolph, no. 324; Cape Henry, Fernald & Griscom, no. 2792, Fernald & Long, no. 3730. FIGS. 3, \times 1, and 4, \times 4, from duplicate TYPE of *C. Nashii*.

Var. **cylindricus** (Ell.), comb. nov. *Mariscus cylindricus* Ell. Sk. Bot. S. C. and Ga. i. 74 (1816). *C. ovularis*, γ *cylindricus* (Ell.) Torr. Ann. Lyc. N. Y. iii. 279 (1836). *C. cylindricus* (Ell.) Britton, Bull. Torr. Bot. Cl. vi. 339 (1879), not Boeckl. (1859). *C. Torreyi* Britton, Bull. Torr. Bot. Cl. xiii. 215 (1886).—Spikelets less crowded than in var. *typicus*, 3–5 mm. long, the lower rarely much reflexed, forming short-cylindric spikes 0.5–1.5 cm. long.—Texas to Florida, north to southern New York. FIGS. 5, \times 1, and 6, \times 4, from type region (Georgia) of *Mariscus cylindricus* Ell.

Var. **Deeringianus** (Britton & Small), comb. nov. *C. Deeringianus* Britton & Small in Small, Man. 151 and 1503 (1933). *C. cylindrostachys* Am. auth., not Boeckl. (1869–70). The coarsest and largest extreme, with spikelets 4–5 mm. long, the lower reflexed as in var.



Photo. E. C. Ogden.

UMBELS OF *CYPERUS STRIGOSUS*, $\times 1$: FIG 1, TYPE in Herb. Linnaeus; FIG. 2, isotype of *C. uniflorus*, from Texas; FIG. 3, immature umbel of *C. uniflorus*, from Texas; FIG. 4, immature umbel, from Maine; FIG. 5, umbel of *C. Hansenii*, from California; FIG. 6, immature umbel, from Mississippi; FIG. 7, immature umbel, from Massachusetts.



Photo. E. C. Ogden.

VARIETIES OF *CYPERUS RETRORSUS*; umbels, $\times 1$; spikes, $\times 4$.Var. *TYPICUS*: FIGS. 1 and 2, from Florida.Var. *NASHII*: FIGS. 3 and 4, from Florida (ISOTYPE).Var. *CYLINDRICUS*: FIGS. 5 and 6, from Georgia.Var. *DEERINGIANUS*: FIGS. 7 and 8, from Virginia.

typicus, forming simple or basally compound ellipsoid to long-cylindric spikes 1–3 cm. long.—Mississippi to Florida and Georgia, here extended north to southeastern VIRGINIA: wet clearings near Grassfield, Norfolk Co., *Fernald & Long*, nos. 3723, 3724; near Great Bridge, Norfolk Co., *Fernald & Long*, no. 3725. FIGS. 7, X 1, and 8, X 4, from Virginia material (no. 3725).

Although the varieties in their extremes are quite recognizable such a complex of transitional colonies occurs that many specimens can be placed only approximately. The achenes of the four varieties seem essentially identical.

CYPERUS FILICULMIS Vahl, var. **oblitus**, var. nov. (TAB. 343, FIGS. 1 et 2), spiculis brevibus 2–4-floris ut in var. *macilento*, sed umbellis valde evolutis radiis elongatis subaequilongis plerumque 5–15; bracteis involuci 5–7 elongatis quam radiis duplo vel usque quintuplo longioribus.—Sandy coastal plain, Maryland to Florida. TYPE: dry pine barrens, Cape Henry, Princess Anne Co., VIRGINIA, September 24, 1933, *Fernald & Griscom*, no. 2793 (in Gray Herb.; isotype in herb. Griscom).

Var. *oblitus* has usually been mistaken for *Cyperus echinatus* (Ell.) Wood, Class-book, 734 (1863)¹ or *C. Baldwinii* Torr. (1836), now passing as *C. globulosus* Aubl. (1775). We have not seen material from Cayenne, whence Aublet described his species, but *C. echinatus* (Ell.) Wood is well matched by West Indian material identified by Britton as *C. globulosus*. From *C. filiculmis*, var. *macilentus* Fern. the new var. *oblitus* differs in its nearly spherical and very full glomerules and in the greater development of the umbel. Var. *macilentus* (FIG. 3) ordinarily has a single terminal glomerule or 1 or 2 short and unequal rays subtended by 2–4 (rarely –5) relatively short bracts; it is widely distributed in the North, from central Maine and southwestern Quebec to Minnesota, south to the coast of Virginia and to Ohio, Indiana, Illinois and Missouri.

Typical *Cyperus filiculmis* of the Atlantic slope is technically a very difficult plant to classify, since it displays the fundamental characters of true *Cyperus* and, at the same time, the diagnostic character of *Mariscus* Gaertn. (1788), not Zinn (1757); i. e. the scales sometimes fall away from the rachis of the spikelet, as in *C. Schweinitzii* Torr. and *C. Houghtonii* Torr., or the whole spikelet is deciduous above the basal empty scales, as in *C. strigosus* L. Specimens with deciduous scales were described as *C. Bushii* Britton, Man. 1044 (1901), from the Great Plains States; but many individuals from Missouri or Oklahoma show mature spikelets disarticulating from the rachis

¹ Name not found in *Index Kewensis*.

Kuntzeal derigere
var. *thos C. Houghtonii* Torr., var. *Bushii*
(Britton) Kuntzeal. Phyt. 20: 469, 1936.

(FIG. 4). Similarly, on the Atlantic slope *C. filiculmis*, although theoretically with persistent scales, often loses them before the fall of the rachis of the spikelet (FIGS. 5 and 6). It seems impossible, therefore, to keep *C. Bushii* apart from *C. filiculmis* or the genus *Mariscus* Gaertn. apart from *Cyperus* L.

Extreme specimens of *Cyperus Schweinitzii* with unusually full inflorescences simulate *C. filiculmis*, as do some phases of *C. Houghtonii*. They may be separated by the following key:

- Scales acuminate, 3.5–4.5 mm. long, the midrib excurrent as a mucro up to 1 mm. long; achenes 2.5–3.5 mm. long; culms scabrous..... *C. Schweinitzii*.
Scales rounded at summit, the midrib scarcely or not at all excurrent; achenes at most 2.3 mm. long.
Achenes short-ellipsoid, $\frac{2}{3}$ as broad as long, 1–1.5 mm. broad. *C. Houghtonii*.
Achenes slenderly oblong-trigonous (as in *C. Schweinitzii*), more than twice as long as broad, less than 1 mm. wide..... *C. filiculmis*.

In the Southeast *Cyperus filiculmis*, var. *oblitus* is easily confused with *C. globulosus* Aubl.; in fact most of the material of this variety has been erroneously distributed as the latter species, due to the inadequacy of current keys. In *C. globulosus* the bases lack the great development of hard corms which mark *C. filiculmis*. The spikelets of *C. globulosus* are slender-pointed and the rachis is broadly winged as in *C. Grayii*. It seems to us that *C. subuniflorus* Britton in Small, Fl. Se. U. S. 173, 1327 (1903), based on *C. uniflorus*, var. *pumilus* Britton, Bull. Torr. Bot. Cl. xi. 87 (1884)¹ is merely small individuals of *C. globulosus*. Several sheets in the Gray Herbarium show both collected as one. We are, likewise, unable to keep out of *C. globulosus* the tropical *C. panamensis* (Clarke) Britton (1925), based on *Mariscus panamensis* Clarke, Kew. Bull. Add. Ser. viii. 15 (1908).

PSILOCARYA SCIRPOIDES Torr., var. **Grimesii**, var. nov. (TAB. 344, FIGS. 1 et 2), formae typicae simillima, major; spiculis lanceolato-cylindricis, lateralibus longius pedicellatis; squamis late lanceolato-acuminatis; bracteolis chartaceis vix herbaceis plerumque enervosis.—

¹ In elevating to specific rank as *C. subuniflorus*, ascribed to Britton, a variety previously published by Britton, Dr. Small cited as its type merely "*Cyperus uniformis* var. *pumilus* Britton, not *C. pumilus* L.," without taking the trouble, comparatively slight for him at the time (and surely intended by the rule for transference or alteration of names which justly requires "the citation of a previously and effectively published description of the group under another name") to record the place and time of publication of *C. "uniformis"* var. *pumilus*. After considerable time-consuming search we have found that Britton described a *C. uniflorus*, var. *pumilus*, which, it is assumed, was what Small meant. It would be quite justifiable to ignore transfers or renamings based upon wholly inadequate citations. Many such transfers are now recognized wholly through courtesy.

VIRGINIA: edge of Lake Drummond, Dismal Swamp, October 2, 1921, *E. J. Grimes*, no. 4534 (TYPE in Gray Herb.), distributed and reported as *P. corymbifera* (C. Wright) Benth. by Grimes, *RHODORA*, xxiv, 148 (1922); pool in sandy barrens, Cape Henry, September 23, 1933, *Fernald & Griscom*, no. 2770.

Typical *Psilocarya scirpoides* (FIGS. 3 and 4) of southern New England (originally described from northeastern Rhode Island) has the nearly sessile spikelets blunter and more ellipsoid-ovoid, with slightly shorter, broader and less attenuate scales, its bracteoles herbaceous and strongly veined, with prominent green midrib. The achenes (FIG. 4) show no appreciable difference from those of var. *Grimesii* (FIG. 2). The more slender and mostly darker spikelets on longer pedicels were conspicuous in the field and the Virginia material is much larger than that of New England (and the Lake Michigan region); it thus strongly simulates *P. corymbifera* (C. Wright) Benth. of Cuba and Florida, for which the Grimes material was mistaken. The characteristic inflorescences of typical *P. scirpoides* (FIG. 3) and of var. *Grimesii* (FIG. 1) and achenes of both, as well as of the type of *P. corymbifera* (FIG. 6), are shown in PLATE 344.

The plant of Sussex Co., Delaware (wet soil, Baltimore Hundred, September 10, 1870, *Commons*), erroneously distributed as *P. nitens* (Vahl) Wood (FIG. 5), is slightly transitional but nearer the typical form of *P. scirpoides*.

ELEOCHARIS FLACCIDA (Reichenb.) Urban, var. *olivacea* (Torr.), comb. nov. *E. olivacea* Torr. Ann. Lyc. N. Y. iii. 300 (1836).

Collections made by ourselves, and other in 1934 by Fernald & Long, show that the characters (color of achene and length of bristles) relied upon to separate *E. olivacea* from the tropical and southern *E. flaccida* break down. The color of scales, likewise, is inconstant, though generally good. Specimens from tropical South America of typical *E. flaccida* sometimes have the bristles as long as in typical *E. olivacea* and the size and shape both of the tubercle and the achene shows too much inconstancy. *E. flaccida* in the South is chiefly in brackish habitats. North of southern New Jersey it is very local, chiefly in tidal estuaries: CONNECTICUT: border of marsh near New Haven, October 6, 1878, *J. A. Allen*; muddy shore, head of Hamburg Cove and muddy shore of Selden's Creek, Lyme, September 10 and 12, 1902, *Graves*. MAINE: Brunswick, August 6, 1894, *C. A. Davis*; tidal mud-flats of Cathance River, Bowdoinham, *Fernald & Long*, no. 12,783.

The best distinctions between the two varieties are the following.

E. FLACCIDA (typical): Spikelets 2–6 mm. long; scales appressed, whitish-green to brown, the lowest 1.5–2.5 mm. long; tubercle with conic center 0.1–0.2 mm. high; bristles reaching to or overtopping achene.—Damp sands and sloughs, Florida to Texas, north on coast to tidal estuaries of New England; Yellowstone Park, Wyoming; Tropical America.

Var. OLIVACEA. Spikelets 4–9 mm. long, more loosely flowered; scales loosely ascending, usually with brown or reddish sides, the lowest 2.3–2.8 mm. long; achenes with slightly prolonged base; tubercle with conic-subulate center 0.2–0.3 mm. high; bristles more often overtopping achene.—Wet sands and peats, Maryland to Nova Scotia; locally inland on wet peat, from Maine to southern Ontario and Minnesota, south to Pennsylvania, Ohio and Michigan.

ELEOCHARIS OBTUSA (Willd.) Schultes, var. JEJUNA Fern. VIRGINIA: wet marsh near North Landing River, Pungo Ferry, Princess Anne Co., Fernald & Griscom, no. 2777.

Var. *jejuna*, as recognized by Svenson in his revision, RHODORA, xxxi. 216 (1929), is not recorded from south of New England.

SCLERIA TRIGLOMERATA Michx., var. GRACILIS Britton. VIRGINIA: dry oak woods, Cape Henry, Fernald & Griscom, no. 2771.

Var. *gracilis* is a well marked extreme, apparently confined to the Coastal Plain, whereas the coarse typical form of the species has a wide continental range. Dr. Britton originally cited var. *gracilis* only from New Jersey, but it is now known from Long Island and from Virginia (see above), North Carolina (Wilson, Wilson Co., Randolph, no. 738) and Mississippi (Biloxi, Tracy, no. 4805).

JUNCUS BIFLORUS Ell. Sk. Bot. S. Car. and Ga. i. 407 (1817). *J. marginatus* β. ? *odoratus* Torr. Fl. N. and Mid. U. S. 362 (1824). *J. heteranthos* Nutt. Trans. Am. Phil. Soc. n. s. v. 153 (1837). *J. odoratus* (Torr.) Steud. Syn. Pl. Glum. ii. 304 (1855). *J. marginatus* var. β. *biflorus* (Ell.) Wood, Class Bk., issue of 1861: 725; Engelm. Trans. St. Louis Acad. ii. 455 (1868) and in Gray, Man. ed. 5: 539 (1867); Buchenau, Engl. Bot. Jahrb. xii. 421 (1890). *J. marginatus aristulatus* Coville Proc. Biol. Soc. Wash. viii. 123 (1893) and later authors, as to plant, not as to type, *J. aristulatus* Michx. Fl. Bor.-Am. i. 193 (1803). *J. aristulatus* Bickn. RHODORA, vi. 174 (1904) and later authors, as to plant, not as to type.

In 1903 the senior author, examining the type of *Juncus aristulatus* Michx., made the memorandum: "small *J. marginatus*, with blunt petals and sharp sepals." Again, with Mr. Bayard Long, he re-examined the type in 1930 and they made a similar memorandum: "One bit of ordinary *J. marginatus* and 3 inflorescences 3–4.5 cm. long by 1–3 cm. broad, with erect branches and remotish 2–3-flowered glomerules; culms capillary, as slender as in small *J. macr.*" Thus Michaux's type well agrees with his original description of *J. ari-*

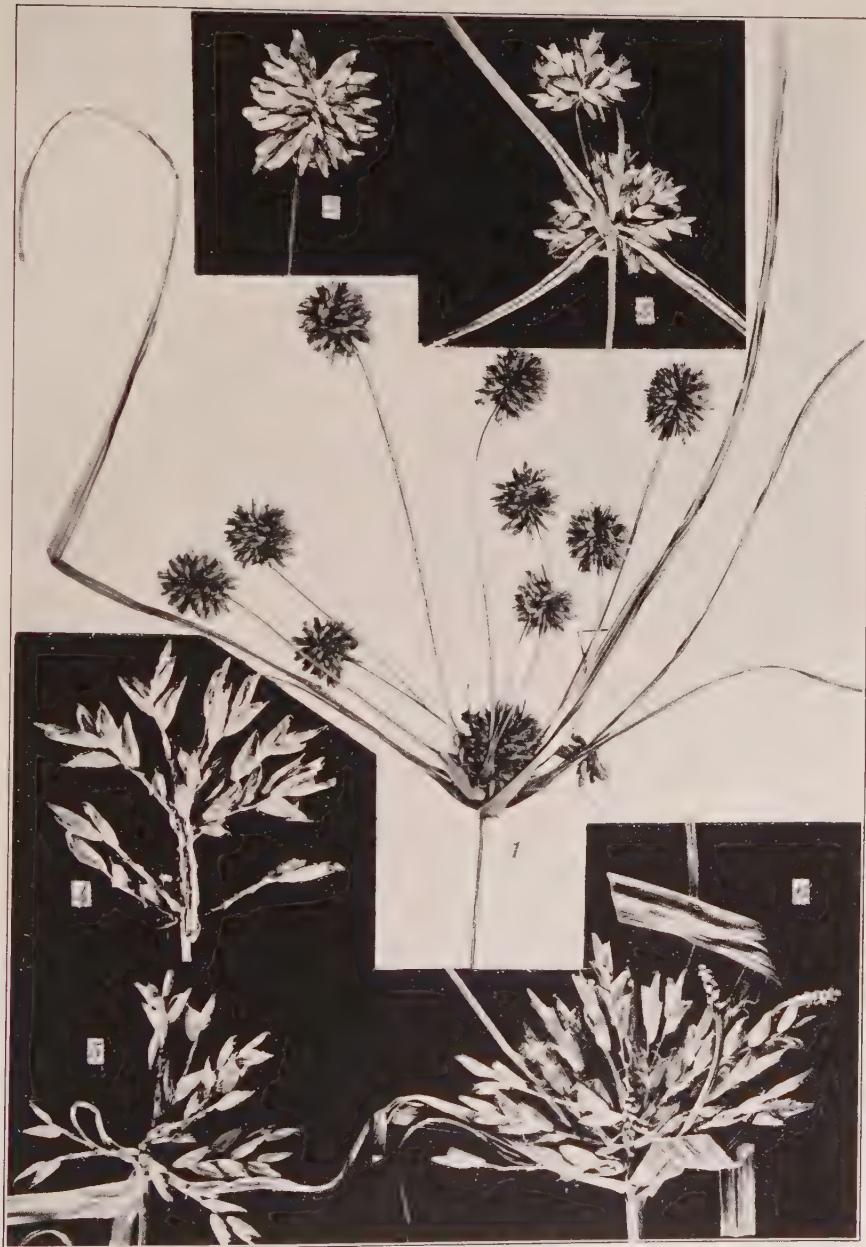


Photo. E. C. Ogden.

CYPERUS FILICULMIS, var. *OBLITUS*: FIG. 1, umbel, $\times 1$, from Virginia (TYPE); FIG. 2, glomerule, $\times 1$, from TYPE.

C. FILICULMIS, var. *MACILENTUS*: FIG. 3, umbel, $\times 1$, from Maine (TYPE).

C. FILICULMIS (typical); ripe glomerules, $\times 2$; FIG. 4, from Oklahoma (*C. Bushii*); FIG. 5, from Massachusetts; FIG. 6, from North Carolina.

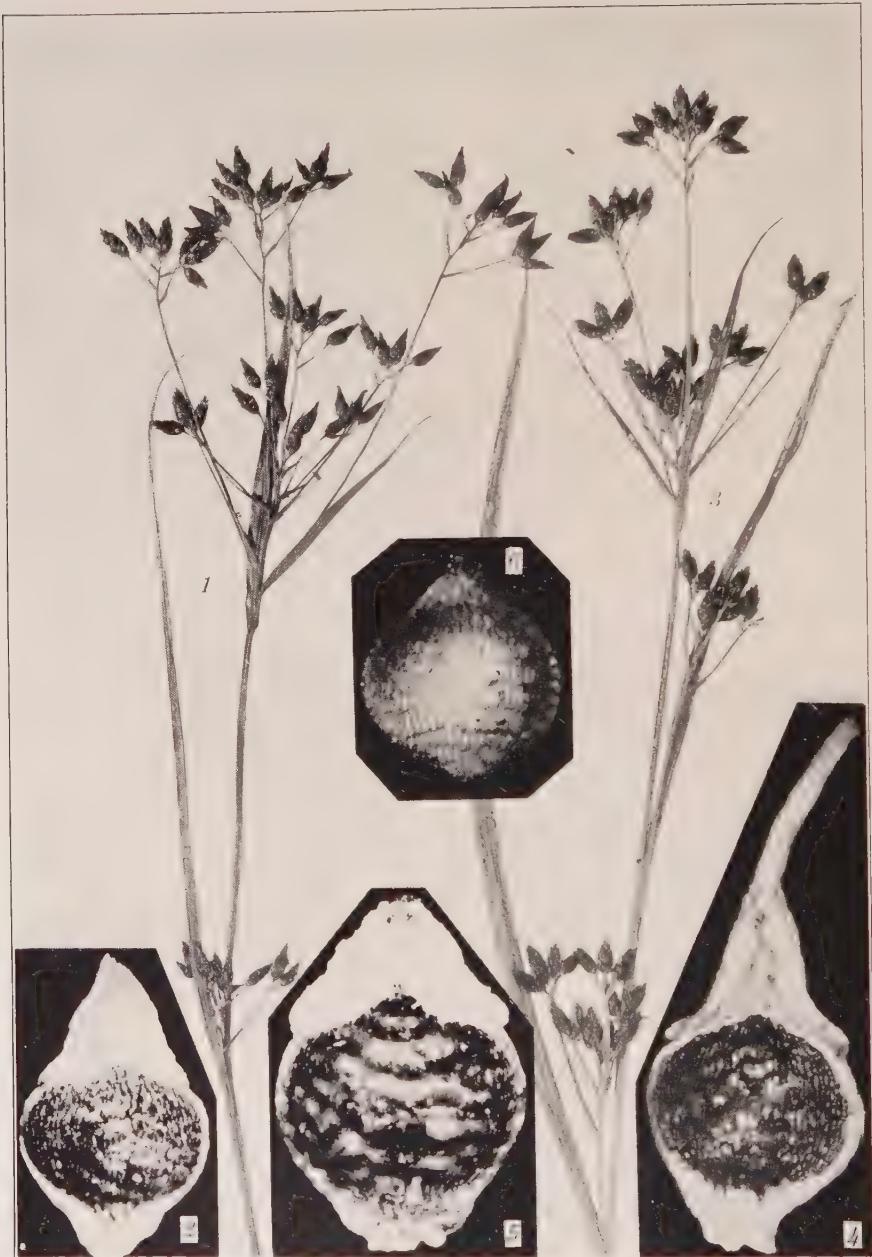


Photo. E. C. Ogden.

PSILOCARYA, inflorescences, $\times 1$; achenes, $\times 35$.

P. SCIRPOIDES: FIGS. 3 and 4, from Massachusetts.

P. SCIRPOIDES, var. *GRIMESII*: FIG. 1, from Cape Henry, Virginia; FIG. 2, from Dismal Swamp, Virginia (TYPE).

P. NITENS: FIG. 5, from South Carolina.

P. CORYMBIFERA: FIG. 6, from Cuba (TYPE).

stulatus, of which he said "Habitus *J. bulbosi*." Several recent collections from eastern North and South Carolina and Georgia agree with Michaux's material and are clearly depauperate *J. marginatus*.

The coarse plant with elongate and nodulose rhizome and solitary culms which has been recently passing as *J. aristulatus* is *J. biflorus* Ell. Most of the southern material has very open inflorescences with remote (1-) 2-3 (-6)-flowered glomerules; while many of the northern and some of the southern specimens have a compact inflorescence and approximate glomerules of 3-6 flowers. While these extremes seem to have no definite geographic localization, loose inflorescences sometimes occurring in the North and dense ones in the South, they are readily recognizable at a glance. Indeed it is surprising that two such striking extremes have no trenchant technical characters, and the situation recalls that in *Juncus macer*. We consequently propose the plant with dense inflorescences as a form, rather than a geographic variety.

JUNCUS BIFLORUS Ell., forma **adinus**, forma nova, inflorescentiis congestis, glomerulis approximatis.—TYPE: dry upper sandy and peaty beach of Saul's Pond, Brewster, MASSACHUSETTS, September 7, 1919, Fernald in Plant. Exsicc. Gray. no. 350 (in Gray Herb.).

(To be continued.)

POLLINATION OF THE ERICACEAE: CHAMAEDAPHNE AND XOLISMA¹

JOHN H. LOVELL AND HARVEY B. LOVELL

CHAMAEDAPHNE CALYCULATA MOENCH

THE leather-leaf, *Chamaedaphne calyculata* Moench, is a low shrub, 2 to 4 feet tall, with slender branches, growing in wet meadows, and bearing coriaceous evergreen leaves which are scurfy beneath. The flower-buds are formed the previous season and open during the following spring from April 20th to May 29th.

The flowers are nodding, $5\frac{1}{2}$ mm. in length, solitary in the axils of the small upper leaves of the terminal racemes, which consist of 10 to 15 flowers. The white corolla is oblong, urn-shaped, narrowing at the apex, with five recurved teeth.

Stamens ten, included in the corolla, filaments white, anthers reddish-brown, awnless, terminating in elongated tubes and opening

¹ Published with aid to Rhodora from the National Academy of Sciences.

by terminal pores. Each anther-tube is tipped by a triangular process. When the proboscis of a bee is inserted into a newly opened flower, it strikes against one of these processes, causing the powdery pollen to fall out of the opening of the corolla on the bee's head. Since the bee inserts only its proboscis into the corolla, should it later visit a flower

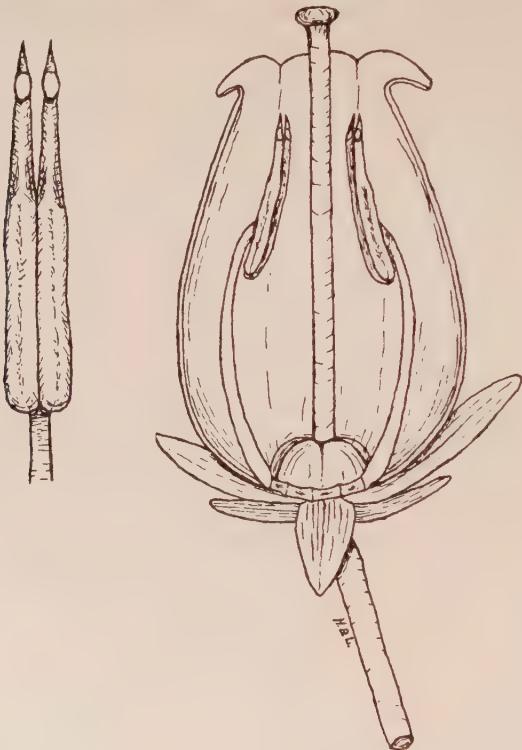


FIG. 1. *CHAMAEDAPHNE CALYCULATA*: *a*, longitudinal section of mature flower, $\times 10$; *b*, stamen, $\times 20$.

with the stigma protruding, its head is certain to come in contact with it and ensure cross-pollination. Pollen white. Nectar is found sparingly between the corolla and the base of the stamens, but it is probably secreted on the disc and escapes between the filaments to the wall of the corolla.

In the bud the style is about the same length as the stamens, with a capitate pink stigma, which later becomes brown. After dehiscence the style increases in length until the stigma protrudes in mature flowers about one millimeter. If pollen falls from the anthers while

the stigma is in the mouth of the corolla, self-pollination will take place.

The following insects were taken on the flowers, all seeking nectar:

APOIDEA: *APIS MELLIFICA* L. ♀; *BOMBUS VAGANS* Sm. ♀ ♂; *B. TERNARIUS* Say ♀; *B. sp.* ♀; *MACROPIS CILIATA* Patt. ♀; *NOMADA BELLA* Cr. ♀ ♂; *N. SUBRUTILA* Lovell & Chll. ♀ ♂; *ANDRENA VICINA* Sm. ♀ ♂; *A. WEEDI* Vier. ♀; *A. CRESSONII* Robt. ♀.

BUTTERFLIES: *LYCAENA PSEUDAGIOLUS* Boisd. & Lec.

DIPTERA: *BOMBILIUS* SP.

Chamaedaphne in this locality blooms while the weather is cold and stormy and is not frequently visited by insects. The above list of species is the result of many and long continued observations. Though there was an apiary not far away only one honey-bee was seen seeking nectar. The visits of the bumblebees were few and very brief—one species was not captured. Andrenid and Nomadine bees were the most frequent visitors. A bee-fly flew to a few flowers but escaped capture. The supply of pollen was meager, and not many seed capsules developed.

XOLISMA LIGUSTRINA BRITT.

Privet Andromeda, *Xolisma ligustrina* Britt., is a small, deciduous-leaved shrub, seldom more than 8 or 9 feet tall, usually growing in damp or wet land but also found in dryer soil at Waldoboro. The dry panicles of seed capsules of the previous season still remain on the branches, when it blooms again in July. The nearly globose white flowers are in terminal panicled racemes, which are many-flowered and leafless. The corolla is constricted at the mouth, with five recurved teeth.

The ten stamens are included in the corolla and are adherent to its base. The filament is flat with the upper portion curved into a U-shaped bow, which acts as a spring to hold the anther-pore against the style, preventing the escape of the pollen from the pendulous flowers. The anthers are brown, and attached to the filaments near their bases, opening by large terminal pores which are directed inward. In buds about to open, the anthers were mature, the pores open, and when the filaments were bent outward and allowed to spring back, the pollen was discharged. The yellow pollen grains are in tetrads.

The green, thick style is about two millimeters long with a small rounded stigma, which appeared to be in a receptive condition in newly opened flowers. The stigma stands slightly in advance of the

mouth of the corolla, rendering the opening so small that bees visiting the flower can not fail to come in contact with it.

According to Knuth¹ the flowers of the closely related genus *Andromeda* are homogamous. In *X. ligustrina* several panicles, which while in bud were covered with fine netting to exclude all insects, produced many seed capsules, though not as many as clusters of flowers which

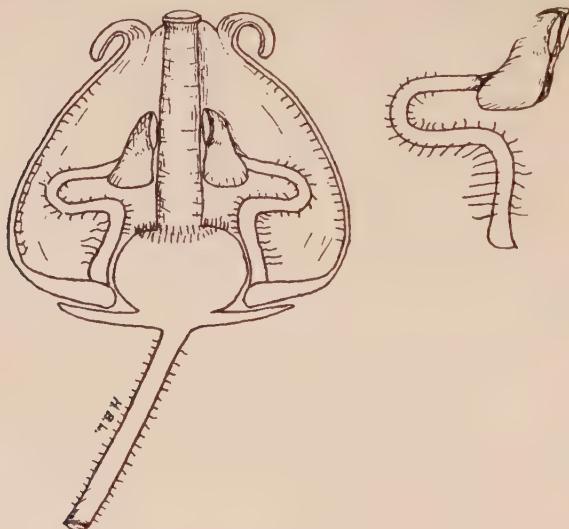


FIG. 2. *XOLISMA LIGUSTRINA*: *a*, longitudinal section of flower, $\times 10$; *b*, stamen, showing bow in filament, $\times 15$.

had not been covered. This species is evidently capable of self-fertilization.

Nectar is apparently secreted by a rim of glandular tissue at the base of the corolla, where it accumulates in considerable quantity. The inside of the corolla and the filaments are covered with hair, which protects the nectar.

Bumblebees were repeatedly observed sucking nectar, their tongues passing at first between the bowed filaments; but later, as the bees turned half or three-fourths of the way around the flower, their tongues passed outside of the filaments. The tongue could be clearly seen through the translucent corolla.

While bumblebees were rather rare on the bloom of the Privet Andromeda, observation of a large bush for two hours showed that

¹Knuth, *Blütenbiologie*, II, pt. 2, p. 37.

all the flowers probably receive several visits during anthesis. *Bombus ternarius* especially was quite abundant, and one specimen was seen to make sixteen visits in one minute.

The flowers are pollinated almost exclusively by bumblebees, though they were not very frequent visitors in the open woodland, where our observations were made. Only a single specimen of the honey-bee, of the Eristalis fly, and of the female of Augochlora were collected. The crab-spider *Misumena vatia* was present in a few flower clusters, and in one instance had captured a worker of *Bombus vagans*.

The following visitors were collected between July 9th and 19th:

APOIDEA: *PSITHYRUS LABORIOSUS* Fabr. ♀ ♂; *BOMBUS VAGANS* Sm. ♀; *B. TERRICOLA* Kirby ♀; *B. TERNARIUS* Say ♀; *AUGOCHLORA CONFUSA* Rob. ♀.

DIPTERA: *ERISTALIS FLAVIPES* Walk.

WALDOBORO, MAINE.

I

LEPIDIUM LATOFOLIUM IN CONNECTICUT.—*Lepidium latifolium* L. is sure to interest any observer on first acquaintance. It is a coarse, somewhat woody plant, 1–1.5 m. or rarely 2 m. tall, with pallid, glaucous stems leafless below at flowering time and a large, stiff panicle. Its multitude of fine white flowers in small corymbs terminating the branchlets soon give way to maturing fruit and an unsightly bare appearance. An extensive underground root-system makes it a bad weed in cultivated land.

In Europe its natural habitat seems to be salt marshes and sea-shores. In such situations it was my good fortune, on July 5, 1934, to find great quantities of the plant, beautifully in flower, in Stamford and Darien, Connecticut, from Cove Island intermittently along the salt shores of Holly Pond, or in some areas in solid ranks for long distances, to the outer reaches of Noroton Bay on Pratt's Island, where it clung tenaciously to wave-washed clefts in exposed ledges.

Extensive salt marshes in Darien have long been reclaimed by gravel "fill" from the Bay; on some of these areas near the shore are many colonies or broad expanses of the plant. It also grows in some fields, roadsides and even in a privet hedge, all well beyond the influence of salt water.

While in flower it is very conspicuous as far as the shores are visible, along a total shore-line of more than three miles.

Mr. Ludlow Griscom at a later date independently observed an

acre of it back of Noroton Beach in the area described. It has been recorded by Albert P. Morse¹ at an inland station in Peabody, Massachusetts, where it was first collected by Mr. R. B. Mackintosh.

The source of the plant in Connecticut may reasonably have been a dye and licorice works in operation on Cove Island for 110 years up to 1914. Ship-loads of crude materials were brought from foreign ports. *Paulownia tomentosa* (Thunb.) Steud. was so introduced near the mills and was once a nuisance, but now persists only as one small tree, half killed during the winter of 1933-34, and a few young plants better protected in a waste of old bricks. A colony of *Lepidium Draba* L. on the shore is conspicuous in its season.

On a half-acre of shallow "fill" over an area of salt marsh in Darien are six or seven clumps 2.5-3.5 m. tall of *Tamarix pentandra* Pall. which may have been introduced in the same way.—EDWIN H. EAMES, Bridgeport, Connecticut.

TWO NEW BOTANICAL JOURNALS.—Two new journals printed, one by the offset process, the second mimeographed, are welcome evidence of the growing mediums for scientific record. The first, *PHYTOLOGIA*,² is a cooperative enterprise, "financed entirely by its contributors, each one paying, in advance, for the entire cost of printing," each share-holder "sharing in the profits, if any accrue." The cost to subscribers is determined by the actual expense of publication; if the subscription list becomes large enough the price will be reduced or the size increased. Articles dealing with or resulting from original research in all fields of botany, as well as biographical sketches and critical reviews will be considered for publication; floristic lists, popular articles, casual notes and polemics will not be printed. The field of Phytologia is, thus, purely technical. The first number (December, 1933) consists entirely of diagnoses of new species and critical notes on others of tropical America. The second number (July, 1934) is devoted chiefly to similar papers on tropical American plants, but with one on Pollinia, and one on the Mahonias of the Pacific States. For its purpose Phytologia promises to be very useful, particularly as it insures more prompt publication than is possible in the longer-established journals which still hold to the dignity of appearing in conventional print and which, at least in the case of RHODORA, are pressed by authors for more space and prompter publication than can always be supplied. The difference between publishing without individual expense in the established and somewhat subsidized journals and paying the cost of publication in Phytologia is, consequently, partly offset by greater promptness. As to cost to contributors: "the basic rate for a page or fraction thereof is \$1.65." At this rate it may become cheaper to print the journal in conventional form (the cover-pages of no. 2 are thus printed), an improvement which will be appreciated by the contributing share-

¹ RHODORA 26: 197. 1924.

² *Phytologia*. Published by H. A. Gleason and Harold N. Moldenke. The New York Botanical Garden, Bronx Park, New York, N. Y. \$5.00 in advance.

holders. As a journal "Designed to expedite botanical publication" *Phytologia* is heartily welcomed.

The second new journal, *CLAYTONIA*,¹ most appropriately named for the pioneer botanist of Virginia, John Clayton, is an outgrowth of the very live activity of the Virginia Academy of Science. The first number (June, 1934) is 10 pages, in mimeograph, giving editorial statement of the origin of the new publication, a brief sketch of John Clayton, a history of the recent efforts of the Academy to coordinate the work on the flora of Virginia and eventually to prepare an authoritative state flora. Following these statements of policy are brief articles on the rarity in Virginia of *Iris virginica*, *Pogonia affinis* and *Parnassia asarifolia*; a section of "Queries and Answers" and another on "New Plants." With a strong appeal to the amateur and the nature-lover and acknowledged support from local garden clubs, *Claytonia* is bound to have a wide usefulness. The work it has undertaken will well repay the effort. May it be wisely guided and richly fruitful.—M. L. F.

A FLORA OF THE NIAGARA FRONTIER.²—It is indeed a pleasure to welcome an addition to the small, though slowly increasing, number of American local floras which can properly be called models of their kind. Such an addition is Mr. C. A. Zenkert's "Flora of the Niagara Frontier Region"—an area approximately that of a circle with a fifty-mile radius and the city of Buffalo as its center. The author has packed into his 300-page volume every feature which a work of its nature ought to have, and all show every evidence of care, thoroughness and competence in execution. The only flaw which has caught the reviewer's eye is that the date of General Sullivan's expedition against the Iroquois is given as 1799 when it should be 1779!

Especial mention should be made of the excellence of Mr. Zenkert's analysis of the effects of the activities of man on the vegetation and of the numerous illustrations of single species, topographic features and ecological groups. For the most part these are skilfully photographed and unusually well printed. The picture of water-lilies on page 307 is not only an ecological study, but a work of art.

The back-bone of any local flora is its systematic list of species. Mr. Zenkert's shows the same high quality as does the rest of his work and is enriched with discriminating comment. It exhibits two interesting innovations. English names which assign a plant to a botanically wrong genus, such as "red cedar" for a species which is really a juniper, are placed within quotation marks, to call attention to the mistaken generic ascription. Two sets of terms are used to express frequency of occurrence—one, "rare" "common" etc. for what may be designated geographic frequency over the entire area of the flora ("distribution in space" Mr. Zenkert calls it); the other, "solitary," "abundant," "dominant," etc., for the relative number of individuals in a given habitat ("density in place" is Mr. Zenkert's phrase). Very possibly this system

¹ *Claytonia*. Published by the Committee on State Flora, of the Virginia Academy of Science at Lynchburg, Virginia. DR. IVEY F. LEWIS, Chairman of Committee, University of Virginia, Charlottesville, RUSKIN S. FREER, Editor, Lynchburg College, Lynchburg.

² The Flora of the Niagara Frontier Region. Bulletin of the Buffalo Society of Natural Sciences, vol. xvi. 1934. pp. x-328. Map and ill. \$2.00.

can be improved upon; but there is no doubt that it tends toward greater accuracy and completeness of statement.

The nomenclature of the list follows that of the seventh edition of Gray's Manual, with "such emendations as have been published since in *Rhodora* and elsewhere." Nobody, perhaps, can be expected to keep wholly abreast of nomenclatural change; and the unnatural vitality of error has often been pointed out. So I find an old mistake of my own staring me in the face, in the ascription of the combination *Thelypteris spinulosa*, var. *intermedia* to me and not to its real author, Nieuwland. And two mistakes of Gray's Manual, *Botrychium obliquum* for the specific name, and *dissectum* for the variety under it (although Clute had long ago pointed out that *dissectum* was the earlier name) and *Eriocaulon articulatum* for the correct *E. septangulare* are propagated for one more bibliographic generation. But Mr. Zenkert's record is on the whole enviably good; in all respects he is to be congratulated on a thoroughly commendable and useful work.—C. A. WEATHERBY, Gray Herbarium.

TWO WESTERN PLANTS ON THE KEWEENAW PENINSULA.—POTENTILLA BLASCHKEANA Turcz. On June 17, 1934, while on a fishing trip, I found a *Potentilla* that was new to me. It was not yet in flower; or rather the first flower of the season was just beginning to open. The plant reminded one of *P. argentea* but it was an erect plant with many stems. On July 2, it was in full bloom. It had a very woody root with a many-headed crown. I split the root and took a part to plant in the garden where it flourished all the rest of the summer. It is the only plant I have seen but it evidently has been there for years, to judge from the size of the root. It keys into *P. Blaschkeana* of the Rocky Mountain region. No. 9723, June 17 & July 2, 1934.

ROSA LUNELLII Greene. While taking a constitutional on Sunday morning, July 15, 1934, I found a rose on the shores of Torch Lake at Hubbell that was entirely unfamiliar to me. It keys into *Rosa Lunellii* Greene, a species of the Dakotahs. There were two or three clumps of it, perhaps all from the same underground system. No. 9934, July 15 & Aug. 12, 1934.—OLIVER A. FARWELL, Lake Linden, Michigan.

Volume 37, no. 435, including pages 77–128 and plates 327–331, was issued 9 March, 1935.

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